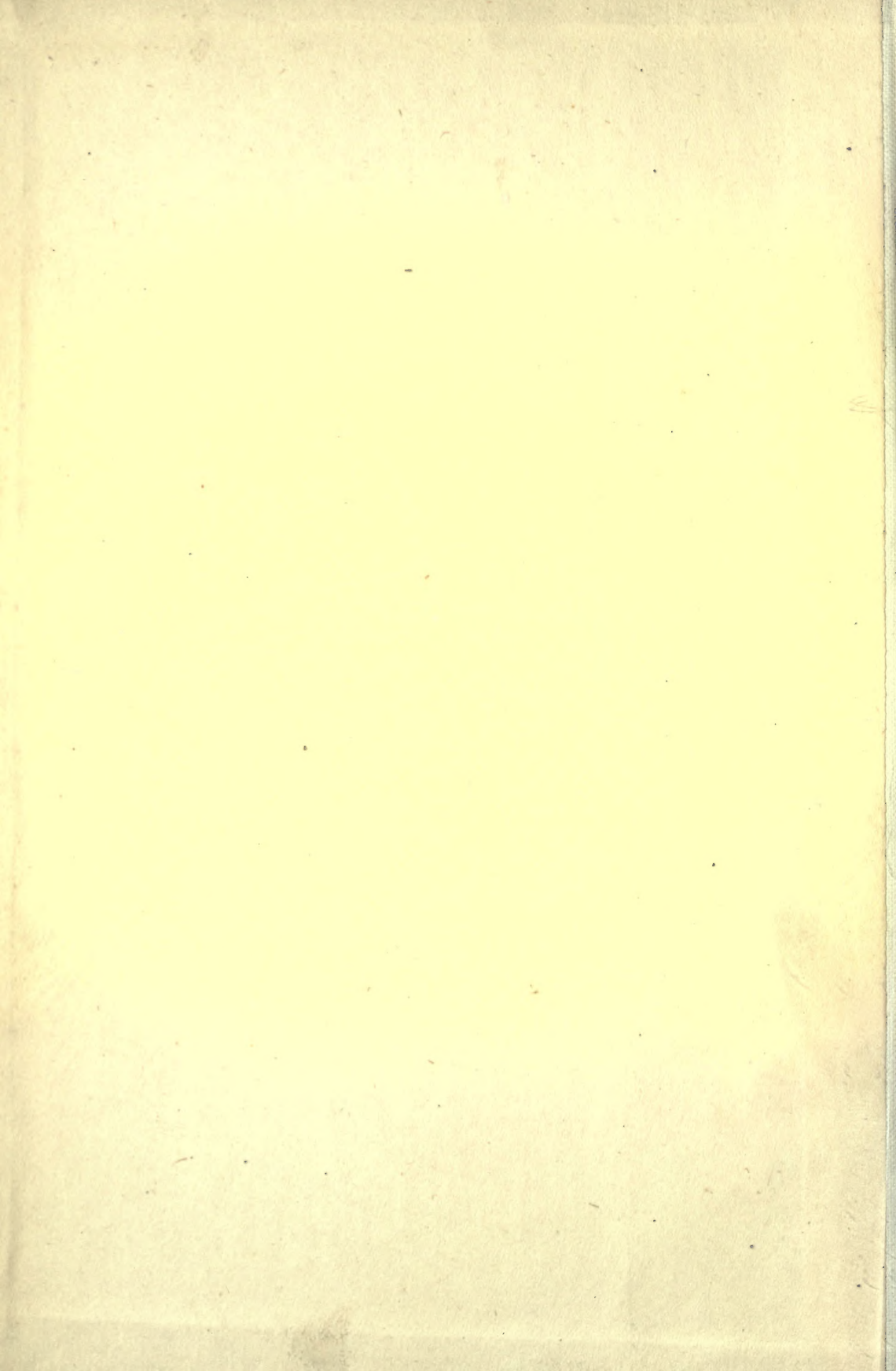


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THE GEOGRAPHICAL REVIEW

VOL. IV

JULY, 1917

NO. 1

AËRONAUTICAL CHARTS

By OMAR B. WHITAKER

The Sperry Gyroscope Company

In November, 1915, the well-known aviator, the late Victor Carlstrom, made a memorable flight from Toronto, Canada, to New York, flying without mishap until his arrival at the latter place, where darkness and a low-lying haze rendered it impossible for him to distinguish Governors Island, his intended destination. Believing it a waste of valuable time to make a further search for Governors Island, Carlstrom headed his machine for New Jersey, where he felt certain that territory suitable for a landing place could be found. He had not traveled far from New York when he sighted a stretch of country that seemed perfectly suited to his needs. When it was too late, however, to prevent a landing, he discovered that the stretch of country was marsh land of the "Jersey Meadows," and it was only by his skill and quick thought that he was able to save himself and his machine. Some idea may be had of his predicament when it is stated that it required a number of workmen and a motor truck several days to extricate the machine from the swamp.

Peculiar as it may seem, but few have given this singular instance much thought—merely accepting it as an aviator's misfortune. Carlstrom's experience was singular in that it happened at the very end of such a noteworthy achievement, but the misjudging of landing places has been the direct cause of many serious accidents which date back to the time when the airplane was first able to leave its home field. Had Carlstrom been equipped with an aëronautical chart of the proper kind, an incident which might have easily proved a serious accident could have been averted. His equipment lacked such a chart for the very good reason that none existed. Clippings from atlas and other small-scale maps showing only towns, railroads, and rivers went to make up the chart that was used for his flight.

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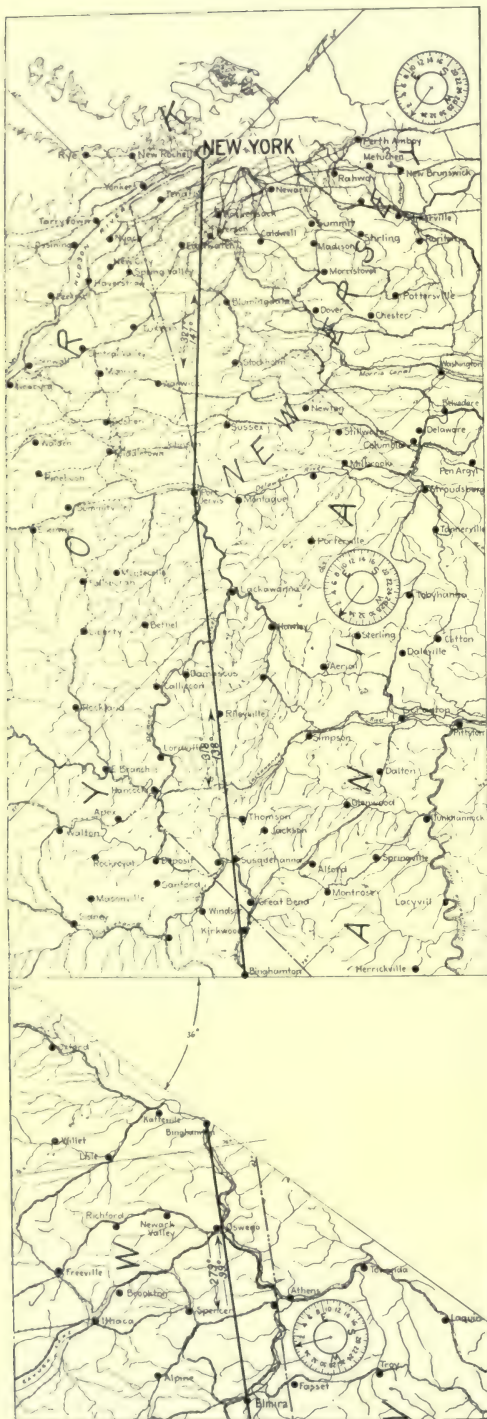


FIG. 1. (For title, see alongside.)

The development of the airplane has been so rapid and so much attention has been centered upon the machine itself that other things which go to help make the airplane a success have suffered neglect. The aeronautical chart is one of these.

The first aeronautical charts used in this country were probably composed of clippings from atlas and other maps, owing to the want of better material. One of the most complete charts of this sort up to that time was doubtless the one prepared for Lawrence Sperry's flight from Amityville, L. I., to Boston in the summer of 1916. As most of his flight was to be made over water, several large-scale standard marine charts covering the route were obtained and the course layed out on them. A strip ten inches wide, five inches either side of the course, was cut from each chart, and in order to facilitate their use the strips were mounted on linen and arranged to run over a pair of rollers.

Numerous requests for information concerning compass

TITLE OF FIG. 1—Reduced facsimile of a section of an aeronautical chart prepared by the Sperry Gyroscope Company, the original being on the scale of 8 miles to the inch. North is at the lower left.

The beginning of the New York-Chicago route is indicated by the heavy black line, each leg of the course being marked by its azimuth, for both going and coming. Wedge-shaped pieces similar to the one shown here are introduced in order to straighten out the turns made by the course and in order to produce a rectilinear map which can be passed over rollers (see Fig. 2.)

errors, the exact course to be steered between stated cities, etc., having been received by the Sperry Gyroscope Company because of their wide experience in aërial navigation, the company decided to meet the rapidly increasing demand by undertaking the preparation of aëronautical charts. A chart of Long Island was the first to be compiled. Shortly afterward a strip of territory from Fort Wadsworth, N. Y., to Princeton, N. J., was charted. This chart, combined with that of Long Island, was used by the group of airmen that flew to Princeton for the football game between Princeton and Yale in November, 1916. The Sperry aëronautical charts are made from

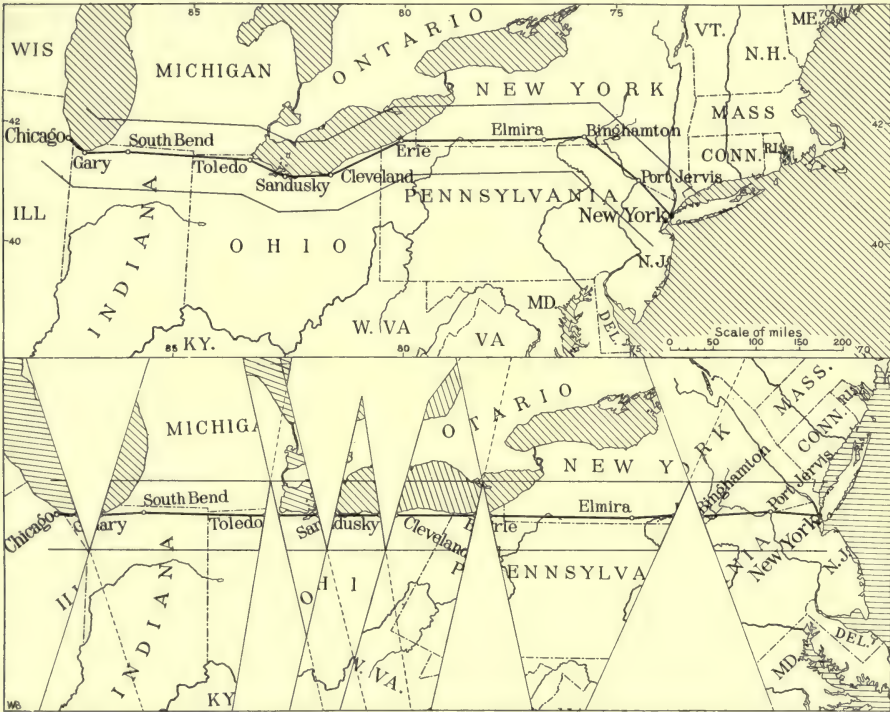


FIG. 2—Outline maps illustrating the method of producing rectilinear aëronautical charts by straightening out the course.

The upper half shows the route between New York and Chicago laid out on a regular map, with the bounding lines indicated of the territory to be included. The lower half shows this map cut apart, as it were, at the turning points in the course and straightened out. In drafting the final map the areas outside the bounding lines are excluded. Figure 1 shows the eastern end of the strip in detail.

maps compiled by the U. S. Geological Survey and are on a scale of from $2\frac{2}{3}$ to 8 miles to the inch. Figure 1 shows the last lap of a Chicago-New York chart. The distinctive feature of these charts is that, regardless of the number of turns made in any particular flight, the whole chart is presented in a straight strip only ten inches wide. The advantage of such a method is that almost any scale may be used without making the chart cumbersome, since it lends itself readily to a pair of chart rollers, which can be mounted in a case and attached to the instrument cowl, if so desired.

The method used to prepare one of these charts may be more clearly shown by a few simple illustrations. The upper half of Figure 2 represents an airplane route between New York and Chicago as laid out on a map and bounded on either side by lines parallel to it and enclosing the strip of country to be charted. The remainder can now be cut away, thus eliminating a large amount of useless map. The straightening out of the course is attained by cutting the chart transversely at each turning point and arranging the separate sections as shown in the lower half of Figure 2. It will be noted from Figure 1 that in the vacant triangular space at the turning points the angular value of the change in the chart is designated. This will also be the change in course to be made at each point, providing the approach and departure are to be made along a course parallel to the sides of the chart, which is not always the case, however. It is better, therefore, to mark each leg of the course with its proper azimuth, as is done on Figure 1. This will also save the pilot the trouble, possibly at a critical time, of first considering whether the change should be added to or subtracted from the reading of his present course and then making the necessary calculation to obtain his new course.

As to content, the charts in question show the location of cities, railroads, and rivers. Up to the present time only one set of these charts has been made in colors, this being the one of Long Island. All of the remainder are in black and white.

Turning now from a discussion of what has been done in this field by one organization, it may be well to consider in general what remains to be done to develop fully this important adjunct of flying.

The requirements made of land charts naturally divide them into two general types: one for cross-country flights and the other for local flights.

Every aeronautical chart should portray all, or as many as possible, of the outstanding and essential features of the territory it covers. Among those of most value to the pilot are cities, towns, roads, railroads, rivers, landing places, altitudes, fuel and oil supply depots, and especially places that appear from above to be good landing places but are in reality swamps or other treacherous ground. The marking of a city or town should show some of its special characteristics, in order to aid the pilot in distinguishing it from other nearby towns of similar size. Probably the day is not far away when every city, town, and hamlet will have its name displayed in such a way that it will be legible from a great altitude. Such a plan would, however, be a disadvantage from a military point of view, as it would readily impart important knowledge to an enemy airman. Towns having facilities for making repairs to the plane should be so designated. Roads and railroads are clearly seen from above and are much used as landmarks. Rivers are also important landmarks and should be clearly designated.

Landing places should be divided into two groups, possible and good

landing places. The advantage of this division is that it gives the airman some choice in his landing place if the need of landing is not immediate. The position of telephone and telegraph wires and other dangerous obstructions should be indicated on all marked landing places. The experience of Victor Carlstrom, as related above, is sufficient proof of the need of marking dangerous territory that might deceive a pilot into believing it a good landing place.

In addition to these elements, all charts should carry a number of compass roses to indicate the meridian and the magnetic declination at various places along the course. A good way to help indicate the course would be to place compass roses at the beginning of each new course and every six or seven inches thereafter, the center of these roses to be on the course line and the north pointing to the magnetic north. The pilot would then have continually before him a graphic representation of the relation of his compass lubber-line to the card. In such a case the course to be steered would be indicated on the rose at the point where the course line passes through it and on the side toward which one may be traveling from the center—this on the assumption that the compass deviation error is negligible.

Charts for local use may be made on a large scale and marked similarly to those just described. A more convenient shape for these charts would be in the form of a rectangle or square with the flying field near the center.

All land charts should be colored in a manner to bring out the landmarks in their relative importance to the airman. The use of a standard code of symbols for indicating many of the country's features will prevent overcrowding and confusion.

The marine aëronautical chart has a very good beginning in the existing standard marine charts. These can be used to good advantage as they now stand, but a few slight modifications may render them even more suitable to the aviator's needs. The soundings need not be recorded, as they are of little or no value to the airman, but it would be well to indicate all of the distinctive features of the country for two or three miles inland. This would act as a great aid to an aviator who may have lost his way and perhaps save him the inconvenience and risk of landing in unfamiliar waters to inquire his whereabouts. Upon first thought it may be inferred that only poor navigation or incorrect course calculation could cause one to become so completely lost, but the wind has succeeded in playing many practical jokes on experienced aviators by carrying them considerably off their course. This is even more likely to be the case on marine than on land trips, owing to the absence of markings at sea.

Fortunately, a considerable amount, if not all, of the material required for aëronautical charts is at present available in the form of government and other maps, but much experience and time will be required to put it into useful form.

POLAND: THE LAND AND THE STATE*

By EUGENIUSZ ROMER

Professor of Geography, University of Lemberg

THE PHYSICAL BASIS OF POLAND'S HISTORY

The foundation of the historical life of nations is laid down in the relatively unchanging features of the earth. Strong and organized human wills can temporarily deflect national life from the course favored by nature, but, sooner or later, life flows back into natural channels, and its return is almost invariably marked by some upheaval in customs, character, or national life.

Let us glance at the relationship between historical life and its natural foundations in the Vistula region. Along this river led the route followed by the Phenicians in their trading voyages to the Baltic for amber, as is evidenced by cowry shells in the form of amulets which have been found in prehistoric tombs along the Baltic littoral. In the fourth century of our era, as one of a series of racial migrations, a Slavic wave appears for the second time, driving the Goths against the Roman Empire. *Pulsae a superioribus barbaris*, says Julius Capitolinus,¹ referring to the Goths. The Slavs continued to push onward, until the limit of their westward expansion was set by Charlemagne, whose name stood for power among the western Slavs.

The western frontier of Slav territory was at that time marked by the rivers Elbe and Saale (Fig. 1).² Settlements on the right bank of those rivers have preserved to this day the evidence of their Slav origin in their characteristic circular and road-side arrangement (termed *Runddörfer* and *Strassendörfer* by German historians). Traces of Slavic colonization are not lacking on the left banks either, but the scattered circular villages

* This article is based on a translation of an original manuscript in Polish by Professor Romer which was received by the Society before the entry of the United States into the war. It was originally accompanied by a series of maps by the author, which, however, were not passed by the military censor. With the guidance of the brief titles and references to the sources interspersed in the text, the present series was compiled. Professor Romer is of course not responsible for the accuracy of either the maps or the translation.

¹ P. J. Schafarik: *Slavische Altertümer*, Leipzig, 1843-44, Vol. 1, p. 507; Montelius: *Die Einwanderung der Slaven*, *Korrespondenz-Blatt für Anthropol., Ethnolog. und Urgeschichte*, Vol. 30, p. 127.

² Figs. 1-3 and 5-12 are based on the following sources (on which plates, is indicated in each instance):

Karl von Spruner: *Hand-Atlas für die Geschichte des Mittelalters und der neueren Zeit*. Revised by Theodor Menke. 90 maps and 376 insets. Justus Perthes, Gotha, 3rd edit., 1879.

G. Droysen: *Allgemeiner Historischer Handatlas*. Edited by Richard Andree. 96 maps. Velhagen & Klasing, Leipzig, 1886.

R. L. Poole: *Historical Atlas of Modern Europe*. 90 maps. Clarendon Press, Oxford, 1902.

F. Schrader: *Atlas de géographie historique*. 55 maps. Hachette et Cie., Paris, edition of 1911.

F. W. Putzger: *Historischer Schul-Atlas zur alten, mittleren und neuen Geschichte*. Edited by Alfred Baldamus and Ernst Schwabe. 234 maps. Velhagen & Klasing, Leipzig, 29th edition, 1905.

W. R. Shepherd: *Historical Atlas*. 216 maps. Henry Holt and Co., New York, 1911. [Based largely on the preceding.]

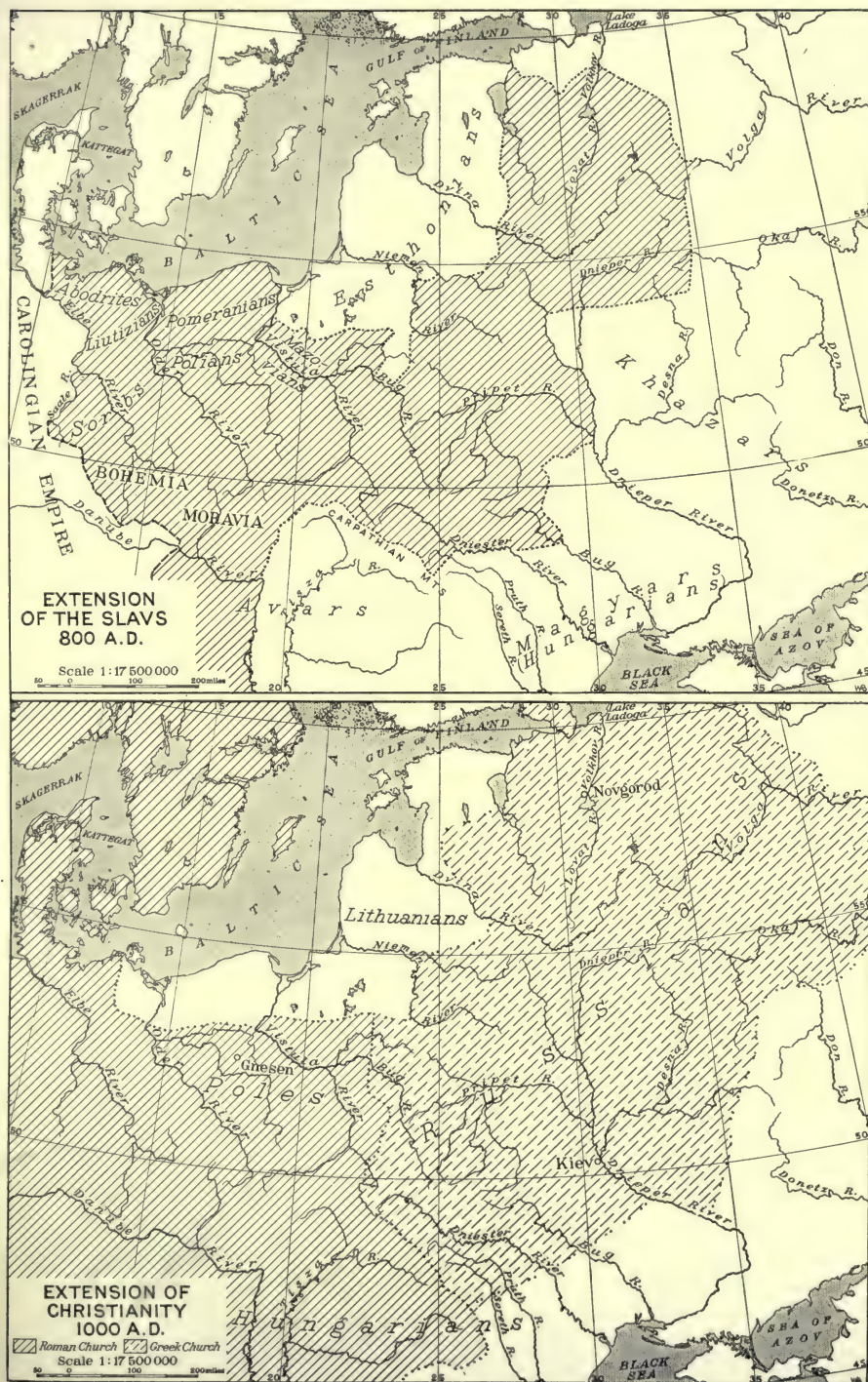


FIG. 1 (upper). Based on Spruner-Menke, Pl. 3, and Shepherd, Pl. 54-55. The area designated "Estonians" included Lithuanians and other tribes.

FIG. 2 (lower). Based on Shepherd, Pl. 66-67, inset. On Spruner-Menke, Pl. 7, a pagan zone intervenes between the Oka River and the Gulf of Finland.

here are less frequent than the predominating village of compact form (*Haufendorf*) typical of Germanic settlements.³

The Slav world of that period extended, in the west, northward to the Baltic between the lower Vistula and the Oder, while farther east it was separated from the sea by the territory of the Esthonian and Lithuanian tribes. In the south it reached the Carpathians, and along the rivers Dniester and Bug it was pushing towards the Black Sea, from which it was barred, however, by the powerful state of the Khazars and their kindred peoples the Bulgars and Magyars. At this period Slav settlements in the northeast extended along the northern affluents of the Dnieper almost to the Gulf of Finland. But they did not quite reach the sea, being stopped by a seemingly small obstacle.

Steep, almost precipitous, escarpments rise in places to a height of one or two hundred feet, over which the affluents of the Gulf of Finland and of Lake Ladoga fall in roaring cataracts. In the face of such obstacles to communication, Slav expansion always halted. For the same reason it avoided the meridional part of the course of the Niemen, between the present sites of Grodno and Kovno, where that river, leaving its upper, relatively shallow valley, flows through a deeply cut and picturesquely winding ravine. Nowhere did the Slavs of those days penetrate into the region of the eastern affluents of the Dnieper. They were held back, possibly, by the main river itself, which flows with great volume at the time of the spring floods. They halted also at the middle of the course of other Black Sea rivers, such as the Dniester and Bug, at the point where these rivers descend from the broad meadows of the upland and enter deep, wooded ravines.

The Slavs of that time moved along broad valleys. They stopped before narrow and winding ravines, at the thresholds of valleys, and in front of waterfalls. They were stopped by Charlemagne on the Elbe where that river, deprived of any western affluents below the mouth of the Saale, is in itself a barrier for a people that moved only along broad valleys.

What were the peoples whom Ptolemy called by the general name of *Venedae*, and Procopius by that of *Sclaveni* or *Slaveni*? Already differentiated, they formed numerous groups in the Frankish period. The eastern of these tribes, nameless at first, were destined to play a prominent part in later history. In the southwest the Bohemian-Moravian group settled down in a hilly country, so situated that it was alike protected from hostile neighbors and accessible both to Roman and Byzantine influences. No wonder, then, that this particular Slavic group made the earliest entry upon the arena of history. Through their German neighbors we happen to know the names of many of the tribes that resided in the western lowlands, such as the Abodrites (Obotrites), the Liutizians, and the Sorbs, all of them belonging

³ A. Meitzen: *Siedelung und Agrarwesen der Westgermanen und Ostgermanen, der Kelten, Römer, Finnen und Slaven: Wanderungen, Anbau und Agrarrecht der Völker Europas nördlich der Alpen*, 3 vols. and atlas, Berlin, 1895: reference in Vol. 3, Part 1, and atlas.

to the group of the Polabs, or Slavs of the Elbe. The history of all these tribes has but one tale to tell: the alternative of extermination or Germanization. To the east of the Polabs resided the Lekhs, or Poles, among whom Nestor, an early chronicler, counts the Polians, Mazovians, Pomeranians, and Liutizians.⁴ From Nestor's account one must conclude that the Liutizians and probably the entire group of the Polabs belonged, in tribe and language, to the Poles (Lekhs). This historical inference is confirmed by linguistic research.⁵ A further inference of importance is to be derived from linguistics. If we cast a glance upon Nitsch's map showing the present distribution of the various forms of Polish⁶ it will be seen that the section where the language is the most homogeneous, where it possesses the smallest number of peculiarities of dialect, and where it most closely approaches the accepted literary form, is located on the westernmost edge of Polish linguistic territory. Is not this extreme peripheral position of the main body of the Polish tongue a proof that Germanization has not been limited to the Polabs alone?

Germanization went hand in hand with Christianity, for, as the eminent historian Potkanski puts it,⁷ together with the cross the German apostles carried into Slavdom the boundary posts of the German state. This movement had its good side, however. It stimulated the Slavs to political organization and, consequently, to an apostolic propaganda of their own as a shield for national independence.

But we are not concerned here with historical processes but with the relationship existing between them and the land. Christianity radiated across Slavdom from both Roman and Byzantine sources. It penetrated through various channels. The movement reached its greatest intensity in the tenth century. Figure 2 illustrates the actual extent of Christianity in the year 1000. This map has a certain resemblance to that of the extension of the Slavs two hundred years before. In the direction of the Baltic, Christianity met the same or even greater obstacles than did Slavdom in the Frankish period. Just as Slavdom had, at that time, avoided the gorge of the Niemen between Grodno and Kovno, so Christianity came to a standstill before this obstacle. In the east Christianity extended farther in the year 1000 than Slavdom did in the time of Charlemagne. Its victorious advance was only stopped on the lower Dnieper where the rapids⁸ caused by the passage of that river through the South Russian granite threshold form an obstacle to navigation.

⁴ Schafarik, *op. cit.*, pp. 349-409.

⁵ Rozwadowski: The Relationship between the Polish and Other Slavonic Languages, *Polish Encyclopedia*, Vol. 2, p. 379. Acad. of Sci., Cracow, 1915. [In Polish.]

⁶ Accompanying Casimir Nitsch: Dialectology of the Polish Language, *Polish Encyclopedia*, Vol. 2, p. 238 ff., Acad. of Sci., Cracow, 1915. [In Polish.]

See also *idem*: Quelques remarques sur la langue polabe, *Archiv für slavische Philologie*, 1907, p. 169 ff.

⁷ Potkanski: Cracow under the Piasts, *Travaux de l'Acad. des Sci. de Cracovie: Classe d'Hist. et de Philos.*, Vol. 35, 1898, p. 170. [In Polish.]

⁸ *Porogy*, literally "thresholds."

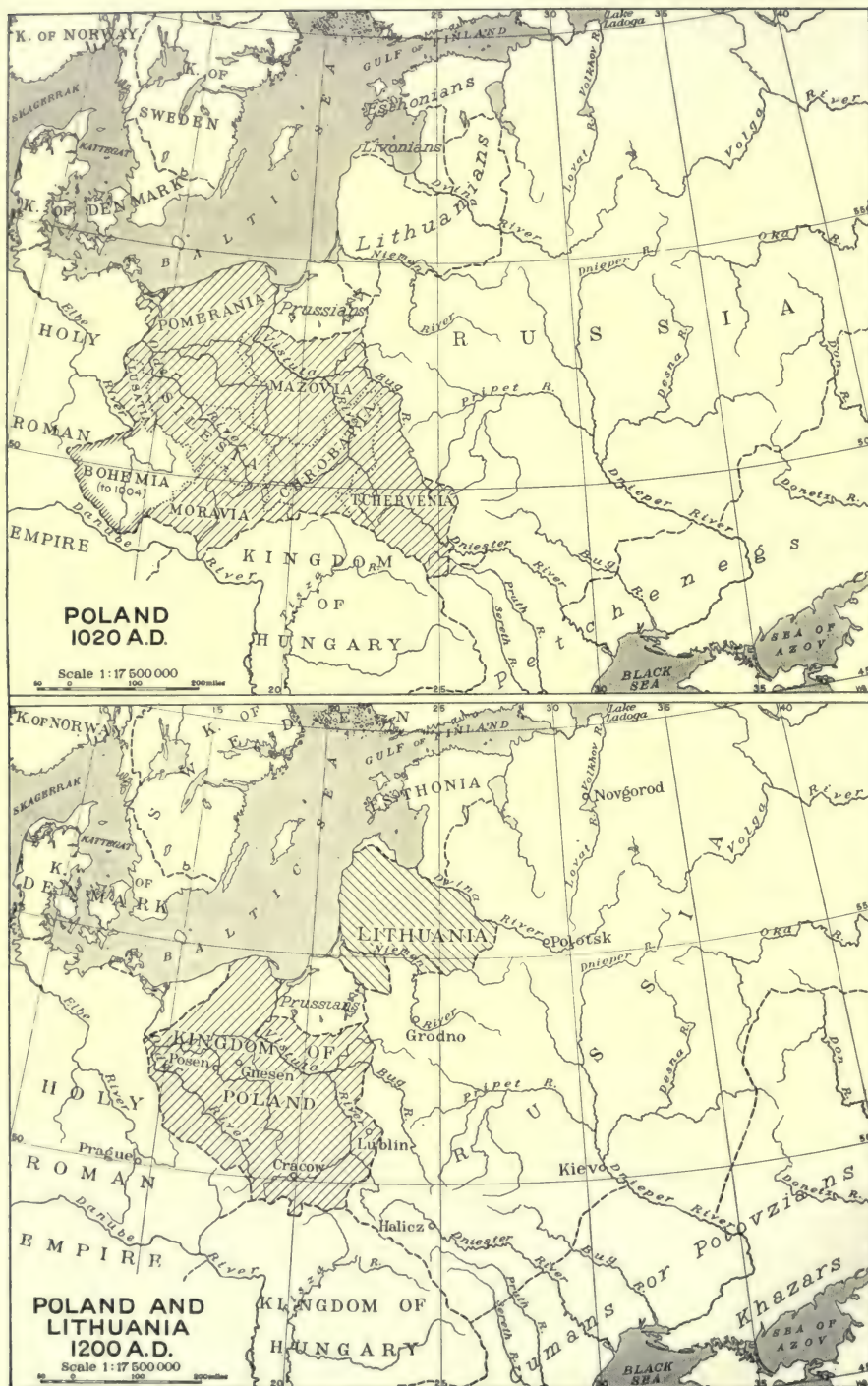


FIG. 3 (upper). Based on Spruner-Menke, Pl. 69, inset, and Putzger, Pl. 15, inset.

FIG. 5 (lower). Based on Shepherd, Pl. 70-71. The term "Russia" on Figs. 3 and 5 is used only in a general sense to group together the various constituent states.

At the end of the tenth century the now fully developed Polish state becomes an historical factor. The political expansion of this state during the reign of Boleslav the Great (992-1025) strikes the keynote of the nation's forthcoming development as conditioned by its geographical setting (Fig. 3). If we eliminate the districts which had succumbed to early Germanization, we are immediately struck by the likeness existing between the extent of Slavdom in 800, of Christianity in 1000, and of the Polish state at the beginning of the eleventh century. When we remember that Poland occupied, under Boleslav's predecessor, in 962, an area of only 40,000 square miles, while it increased fifty years later to over 170,000 square miles, it becomes evident that the sword of Boleslav had found a powerful ally in the individuality of the land.

THE NATURAL HIGHWAYS OF POLAND'S POLITICAL EXPANSION

The territorial extent of Poland at the time of Boleslav and its subsequent history demonstrate the importance of four great natural highways:

(1) The series of great east-and-west valleys (Fig. 4) which extend across the Polish-German lowland from the Pripet to the Elbe⁹ athwart

whose eastern end the Poland of Boleslav came to halt on the line of the Bug.¹⁰ This fact, at variance with the contemporary expansion of Christianity and also with that of Slavdom in 800, is explained by the simultaneous rise, out of the Slavic body, of two states, that of the Ruthenia of Kiev and that of Poland, both of them moving to some extent along the same road and pressing upon each other on the line of the Bug.

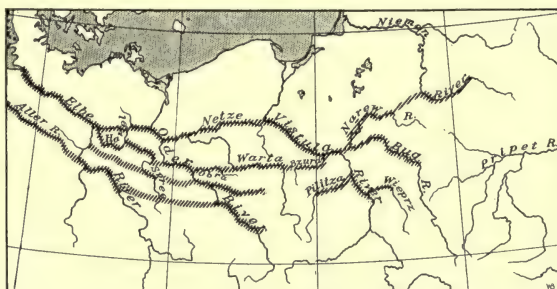


FIG. 4—The east-and-west, proglacial valleys of the Polish-German Lowland. Scale, 1:17,500,000. Based on Wahnschaffe and Keilhack (see footnote 9), extended to the east according to Hettner: *Länderkunde von Europa*.

(2) The southeastern highway, along which Poland acquired, at the dawn of her history, that part of Ruthenia called Red Russia, and which brought Boleslav, on the trail of Christianity, to the gates of Kiev.

⁹ The *Urstromtäler*, or proglacial valleys, of German geologists. See F. Wahnschaffe: *Die Oberflächen-gestaltung des norddeutschen Flachlandes*, with map, *Forschungen zur deutschen Landes- und Volkskunde*, Vol. 6, No. 1, 3rd edit., Stuttgart, 1909; and K. Keilhack: *Die Stillstandslagen des letzten Inlandeises und die hydrographische Entwicklung des pommerschen Küstengebietes*, with map, *Jahrb. Kgl. Preuss. Landesanstalt*, 1898, pp. 90-152.—EDIT. NOTE.

¹⁰ The main right tributary of the Vistula. Not to be confused with the river of the same name, previously referred to, which drains into the Black Sea. In Russian, as in English, both names are spelled alike, but in Polish the former is written *Bug* and the latter *Boh*.—EDIT. NOTE.

(3) The southwestern highway, through which Boleslav's Poland reached the hills of Bohemia and Moravia and even advanced to the Danube.

(4) The northern, Baltic highway, along which Poland first attained the sea.

Of all these highways only the east-and-west valleys were entirely free from natural obstacles. Poland's development in an easterly direction had no obstacle to fear but that of some other organized national will: a Lithuania or Ruthenia. All the other highways, although definitely marked out by the natural features of the country, partook of the nature of defiles. Whoever held the defile became master of the adjoining territory. The valiant armies of Boleslav forced the southwestern defile¹¹ and at once came into possession of the Bohemian lands, extending as far as the Danube. But during the entire century that preceded the expansion under Boleslav, this defile had been held by the Bohemians, and, consequently, all Polish territory as far north as the hills of Little Poland and as far east as the Bug was under the control of Bohemia. After Boleslav's time this district reverted to Bohemia, and, although the country to the north of the Carpathians remained Polish, the province of Silesia, separated from Poland by a wilderness of sands and woods, detached itself from her politically.

A similar statement is true of the southeastern highway, Red Russia having been in turn controlled by Cracow and Kiev. Only after the power of Kiev had been paralyzed by the Tatar shock in the thirteenth century did Red Russia, linked to Poland by the gateway of Przemyśl, steadily gravitate towards the west. Nothing more clearly demonstrates the physical influences at work in Ruthenian history than the fact that Red Russia, located near the Polish gate of Przemyśl, became the first district, and for many centuries remained the only district, where Romanism tried to make inroads into the Byzantine see.

The Baltic highway was less dangerous. It possessed no "hinterland" and, accordingly, at first contained no source of danger. But the passage from the broad valley floors of the Warta and Notetz (Netze) to the Baltic Heights was rendered so difficult by the lack of natural ways of communication that only in her most brilliant period could Poland exert an efficient control over that gate. And when, during a period of weakness, she allowed the Knights of the Teutonic Order to organize on the lower Vistula and they allied themselves to the rulers of the March of Brandenburg, which had been erected on the ruins of Polabian Slavdom—then in that very region arose the greatest danger to the Polish state.

THE LITHUANIAN HIGHWAY

Besides these four, another natural highway, that which linked the north with the south, has played a large part in Poland's history. Even as

¹¹ The "Moravian Gate," the depression between the Sudetic Mountains and the Carpathians.

early as the time of Charlemagne it had been a decisive factor in the expansion of the Slavs. This is the Lithuanian highway.

The Lithuanians are an Indo-European tribe of the Baltic group, mentioned for the first time by Tacitus under the name of *Aestii*.¹² This people possessed, in its native ability and its favorable location on a long coast line, elements with which to evolve a powerful state. After the Teutonic Knights had settled down and conquered the Prussians, one of the tribes of the same Baltic group, and after the organization of a similar military order on the lower Dvina had suppressed the Letts—still another tribe of that group—the Lithuanians alone saved their independence by quick political organization and by the aid of Ruthenia, a state which at the time was highly advanced in culture.¹³ But young Lithuania's geographical position in itself augured well for an immense territorial growth.

Until the end of the twelfth century Lithuania was confined to the monotonous Baltic region and did not extend inland beyond the bend of the Niemen near Kovno where the river issues from its winding ravine (Fig. 5). Having been hard pressed by the Teutonic Knights during the thirteenth century, the Lithuanians at last emerged beyond the valley of the Vilia and took possession of the highroads which dominate the great southern route along the Berezina into the territory of Ruthenia. Thus in a single century, from a small nucleus a great state developed (Fig. 6). The territory of Lithuania before the time of Mendog (1240-63) covered 30,000 square miles. In the time of Olgierd (1345-77) it covered nearly 250,000 square miles.

The study of the preceding maps leads us to the recognition of a general law. Within the Polish state, and at the stage of its greatest development, there existed a sheaf, as it were, of natural highways, with the heart of Poland for its knot, all of which roads gradually faded away to the east beyond the Dnieper. Poland was the natural link between west and east, that function coming to an end beyond the Dnieper. Here, broadly, ended the territory which aroused in states and commonwealths the impulse known in German history as the *Drang nach Osten*. This impulse, indeed, dominates the entire history of Poland; signs of it are not lacking even in the history of France. The reason for this lies in the general arrangement of the river systems in that part of Europe.

All the rivers in this region, in the lower part of their course, receive practically all of their tributaries from the right, that is, from the east. The basin of the Loire points to a connection with that of the Seine, while the numerous right affluents of the latter direct the expansion of France toward Belgian lands, as witness the Walloons. Farther east the same condition holds true (see Fig. 4): the Weser receives, on the right, the Aller; the Elbe receives the Spree with the Havel; the Oder, the Warta with the

¹² Tacitus: *Germania*, Chapter 45.

¹³ Rozwadowski: *The Baltic Languages*, *Polish Encyclopedia*, Vol. 2, Acad. of Sci., Cracow, 1915. [In Polish.]

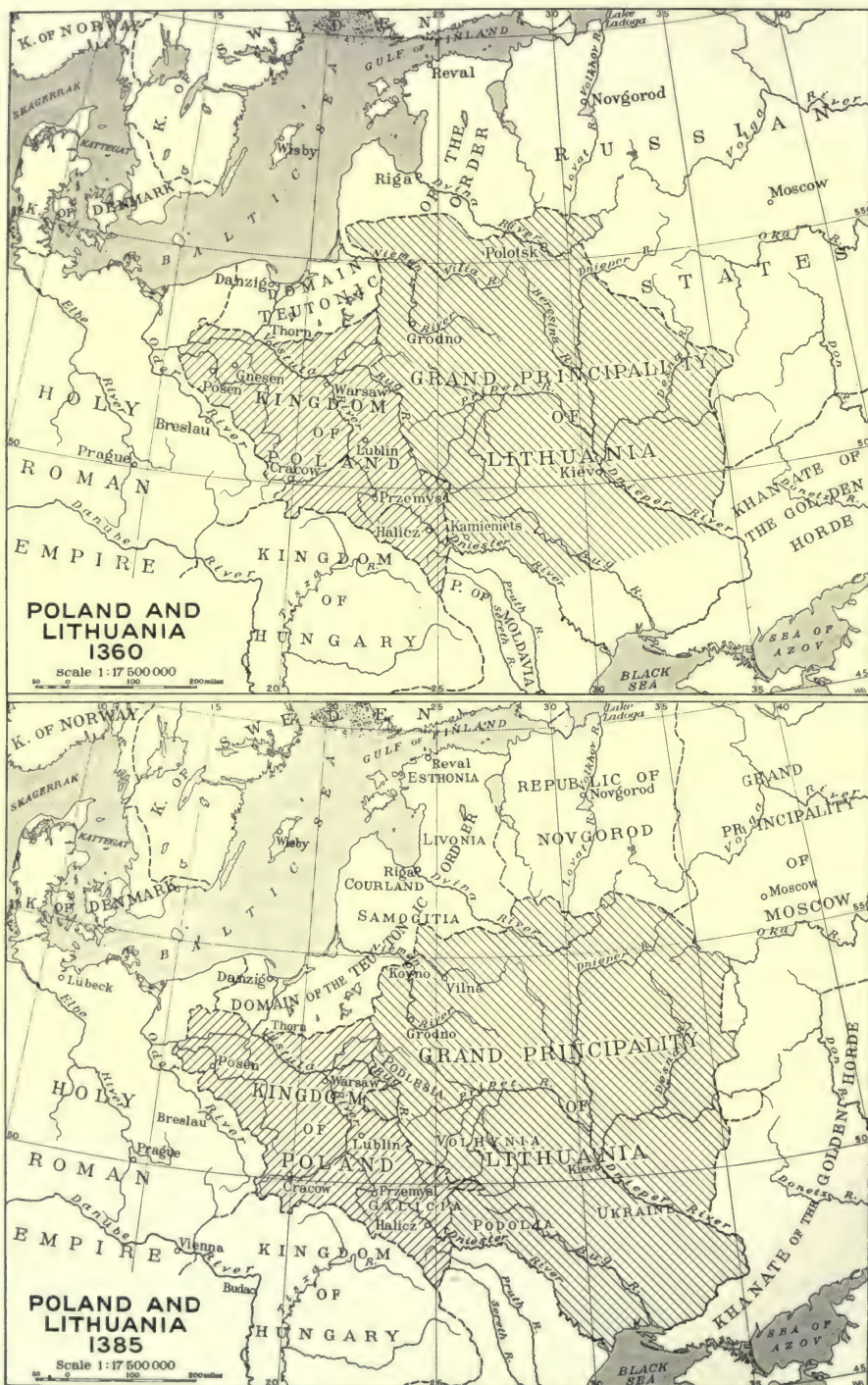


FIG. 6 (upper). Based on Shepherd, Pl. 77.

FIG. 7 (lower). Based on Spruner-Menke, Pl. 69, and Putzger, Pl. 176 and Pl. 196, lower.

Notetz (Netze); the Vistula receives the San, pointing to the Dniester, the Bug, which connects her with the basin of the Dnieper by means of the Pripet, and the Narew, which links her to the Niemen. The Niemen, finally, receives the Vilia, leading on to the Dvina. Beyond the Dvina this arrangement is less conspicuous, while beyond the Dnieper it vanishes altogether.

This brief summary shows that the topography favorable to eastward racial pressure has attained its climax of development in the basin of the Vistula. That the term *Drang nach Osten* is identified more especially with German history is due not to a greater suitability of the German region to this tendency, but, on the whole, to the way in which the German people have utilized it. This tendency has expressed itself quite differently in Poland's history. In order fully to understand the difference, it is necessary to take into account yet another feature of the Polish region and compare it with the history of Russia. Poland, limited on the south by the Carpathians, is not a plane gradually sloping from there to the sea: it is a broad depression leading from west to east, into which the rivers flow in a concentric direction and out of which they flow into both the Baltic and the Black Sea through deeply cut gorges or winding ravines, across the lake-dotted uplands of the Baltic Heights and the broad plateaus that slope down to the Black Sea. The affluents of the Vistula, more numerous from the east than is the case with any of the other river systems to the west, would indeed seem to have assigned to Poland an eastward expansion on a scale impossible in the west, where the lowland belt is narrower. How different the map of Europe might now be had not the Poles been a people whose social and political institutions were directly opposed to the spirit of conquest!

No such physical basis for expansion in one direction only exists in Russia. Here the general character of the land favors an altogether different movement. In contrast to the shallow bowl shape of the Polish region, Great Russia, the core of Russia, may be likened in shape to a flat dome from which the waters of all the great rivers—Volga, Oka, Don, Desna, upper Dnieper, and Dvina—flow outwards, imparting an impulse to the race bred in that cradle to expand in all directions. It is no wonder, therefore, that the Lithuanians, on the one hand facing a physical configuration that threatened them from both north and east and, on the other, open to unobstructed intercourse with unaggressive Poland, tendered a fraternal hand to the Poles and brought about the voluntary union of their two countries, an instance almost unique in history.

THE RELATION BETWEEN THE BOUNDARIES OF POLAND AND HER RIVERS

Having analyzed Poland's history in the light of the physical features of the land, let us examine the question of her boundaries from the same point of view. Consider, for example, the evolution of Polish frontiers as influenced by the union of Poland with Lithuania. Figure 7 shows the

boundaries at the time of the first (a personal) union. This map illustrates the necessity for that union. It was born of the western danger, the beating back of Poland from the Baltic. This danger was deadly, in spite of the country's open access to the Black Sea, which had lost in importance since the rise of Turkish power. The union became a source of strength that entirely removed the Germanic menace: the Teutonic Knights were beaten and an extended coast line was secured on the Baltic Sea. Figure 8 illustrates this state of affairs. It also shows, however, that wrestling with the western foe had weakened the defense against the eastern danger. In the east Poland established defensive border lines by retiring to two great rivers: the Dvina and the Dnieper. The eastern peril growing, the personal union of the rulers became strengthened by a real union of the two countries (1569). Figure 9 indicates the results: the Baltic coast-line is extended, the eastern frontier is shifted far beyond the line of the main rivers, almost to their watersheds. This is Poland's most brilliant picture. The evil omen of decline already appears on the horizon in the form of vassal Prussia, now freed by the will of sovereign Poland.

In these three instances, to which many others might be added, the physiographic law of frontiers is exemplified. Frontiers are, as it were, snap-shots of the life of nations. Being an expression of that life, they can temporarily only, or as a symptom of decay, follow the valleys of main rivers. Main rivers are arteries of national life which cannot, without exposure to fatal blows, be situated on the periphery of a living organism. Hence the vital expansion of a nation always tends to proceed beyond the valleys toward the watersheds.¹⁴

THE BOUNDARIES OF POLAND'S PROVINCES AND HER RIVERS

Rivers not only were decisive factors in determining the direction and extent of Poland's expansion as a whole, but also in determining her subdivisions. For, in the lowland area that is Poland, the configuration of the land is in great part dependent on the drainage system. As a consequence there developed a division into the longitudinal zones characteristic of the Polish state. The first zone is the broad belt of the great east-and-west valleys, the cradle and center of Poland, including Great Poland, Cuyavia, and Mazovia (see Fig. 11). The second is the zone of moderate relief which includes the Polish Heights within the arc of the upper Vistula and the foothills of the Carpathians and Sudetic Mountains, that is, Silesia, (see Fig. 10) and Little Poland, and, in prolongation thereof, Red Russia (Fig. 11), the transition ground between Poland and the Ruthenia of

¹⁴ While this law has many historical illustrations and applies with singular force to Polish nationality, it is by no means acceptable as a living principle in the solution of the many involved problems of today. National expansion in the old sense has reached its culmination, whether or not national boundaries correspond to the limits of topographic provinces. The rights of small nations and weak peoples will never again be interpreted through the interests of powerful neighbors and through "laws" designed not to secure international rights but to further national ambitions.—EDIT. NOTE.

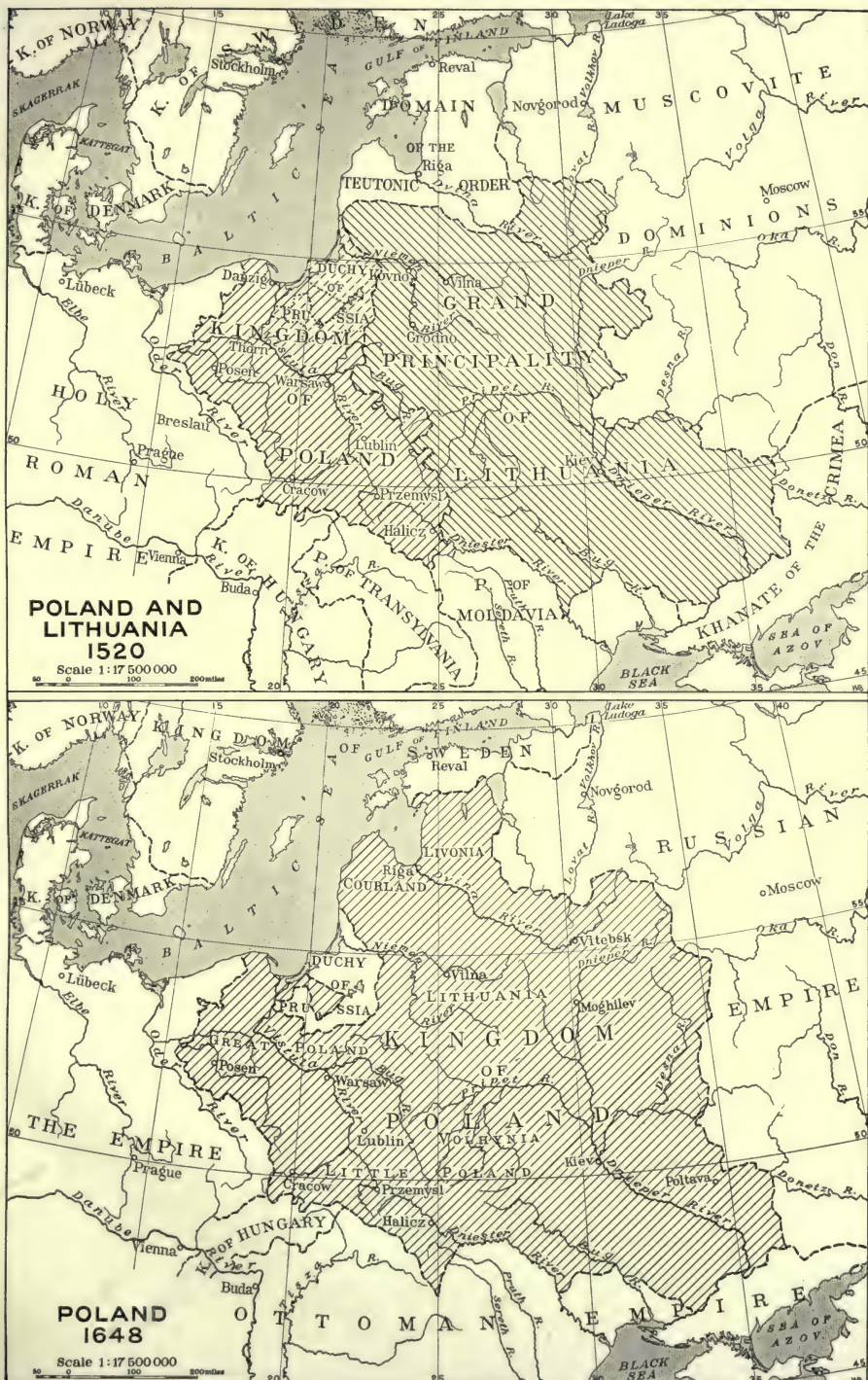


FIG. 8 (upper). Based on Droysen, Pl. 37.

FIG. 9 (lower). Based on Droysen, Pl. 40.

Kiev, as Silesia had been the link between Poland and Bohemia. Finally, the third zone is the coastal region, including Pomerania and Prussia.

These political subdivisions, based on the physiognomy of the country, again reflect the fundamental fact that the main waterways were always the axes, never the border lines, of vital parts of the Polish organism. This is true even for Poland's first period of weakness, when she had fallen apart



FIG. 10—The subdivisions of Poland in 1240. Scale, 1:17,500,000. Based on Spruner-Menke, Pl. 69, inset.

into numerous separate sections and the rulers of these petty states were fighting one another. Never even in this period did a great river become a border line, not the Vistula or the Warta, nor yet the Notetz or the Pilitza.

Furthermore, just as the division and organization of the territory were based upon the character of the land, so did the nation itself draw its racial and spiritual characteristics from the soil. Pomeranian, Polian, Mazovian, Cuyavian, Silesian, etc., are not names derived, as some think,¹⁵ from political terminology; they are the

names of Polish tribes, differentiated among themselves by slight peculiarities, but all of them stamped by the individuality of the land. A novel and conclusive argument in this respect has been furnished by the researches of Nitsch, who has demonstrated that the dialectical peculiarities of the Polish language correspond exactly to the division into provinces at the time of the Piast dynasty, and also to the primitive divisions into eparchies.¹⁶

The dependence of even the smallest units of Poland's political structure on the physiognomy of the land, as exemplified by Figures 10 and 11, is so close that the calamity of the partition appears all the more painful to Polish minds. It not only struck a deadly blow at the state, but, by tearing up the frontiers of districts and autonomous provinces, shook to its innermost foundations the social and economic life of the nation. The boundaries which the various partitions of Poland (Fig. 12) have introduced into the political map of Europe have been destructive and not constructive. Rivers which once pulsed with life have now become merely dead border lines.

The actors in the crime perpetrated upon the Polish nation separated themselves from one another by boundary lines that followed rivers. Assuredly strife would not be long in breaking out again. One can hardly refrain from quoting the words of the poet, who foresaw the part to be played by the river frontier:

¹⁵ K. Kretschmer: *Historische Geographie von Mitteleuropa*, Munich, 1904, p. 173.

¹⁶ Nitsch, *op. cit.*, p. 319 ff.

The Niemen separates the Lithuanians from their foes:

On this side throngs of Lithuanian youths

On the other, in helmet and armor,
The Germans on horseback stand immovable.
Each party watches the crossing.

So the Niemen, once famed for hospitality,
That linked the realms of fraternal nations,
Now for them has become the threshold of eternity:
For none without loss of life or liberty
Could cross the forbidden waters.

(Adam Mickiewicz, *Konrad Wallenrod*)

THE EASTERN MARGIN OF POLAND

An additional example of the interdependence of geography and history is afforded by the river systems of Russia and Poland.

The importance of artificial waterways and connections has been adequately appreciated only in the eighteenth and nineteenth centuries. In the Russian and Polish lowlands such waterways were of particular moment. The fact that roads could not readily be built, because of the lack of stone, added to the importance of the rivers, and much was done to improve them even in the period of Poland's decline. Still greater improvement has been made upon them by Russia in the nineteenth century. Russia was obliged to try to unite in the most efficient manner an expanse whose very dimensions gave rise to centrifugal tendencies. So much has been done that it is safe to say that all the channels in any way suited to artificial reconstruction have been utilized. Russian waterways can be improved but they cannot be multiplied, at least as far as the main channels are concerned. The Volga is now linked with Lakes Ladoga and Onega and with the Northern Dvina; Lake Onega with the Northern Dvina, the Northern Dvina with the Kama; the Msta, belonging to the same system as the Volkhov (see the maps), with the Volga, the Volga with the Don. The result is that the Baltic and the Arctic Sea are connected with the Black and the Caspian Sea by a system of waterways. Of Polish waterways, the Dnieper is linked to the Dvina, as well as to the Niemen and Vistula. In the same way the Niemen is connected with the Windawa (which flows through Courland into the Baltic); and the Vistula with the Niemen, the Dnieper, and, almost, the Dniester (a project of the famous Beauplan reaching back to the seventeenth century). Thus a second chain of waterways unites the Baltic with the Black Sea. Each of these systems, the Russian and the Polish, are mutually connected, but it will be noticed that they are not joined one with the other. This is no accident, for nature has nowhere provided a convenient channel. This separateness of the two regions has been reflected by the course of Polish expansion, whose natural limit was along the Dnieper-Don watershed.

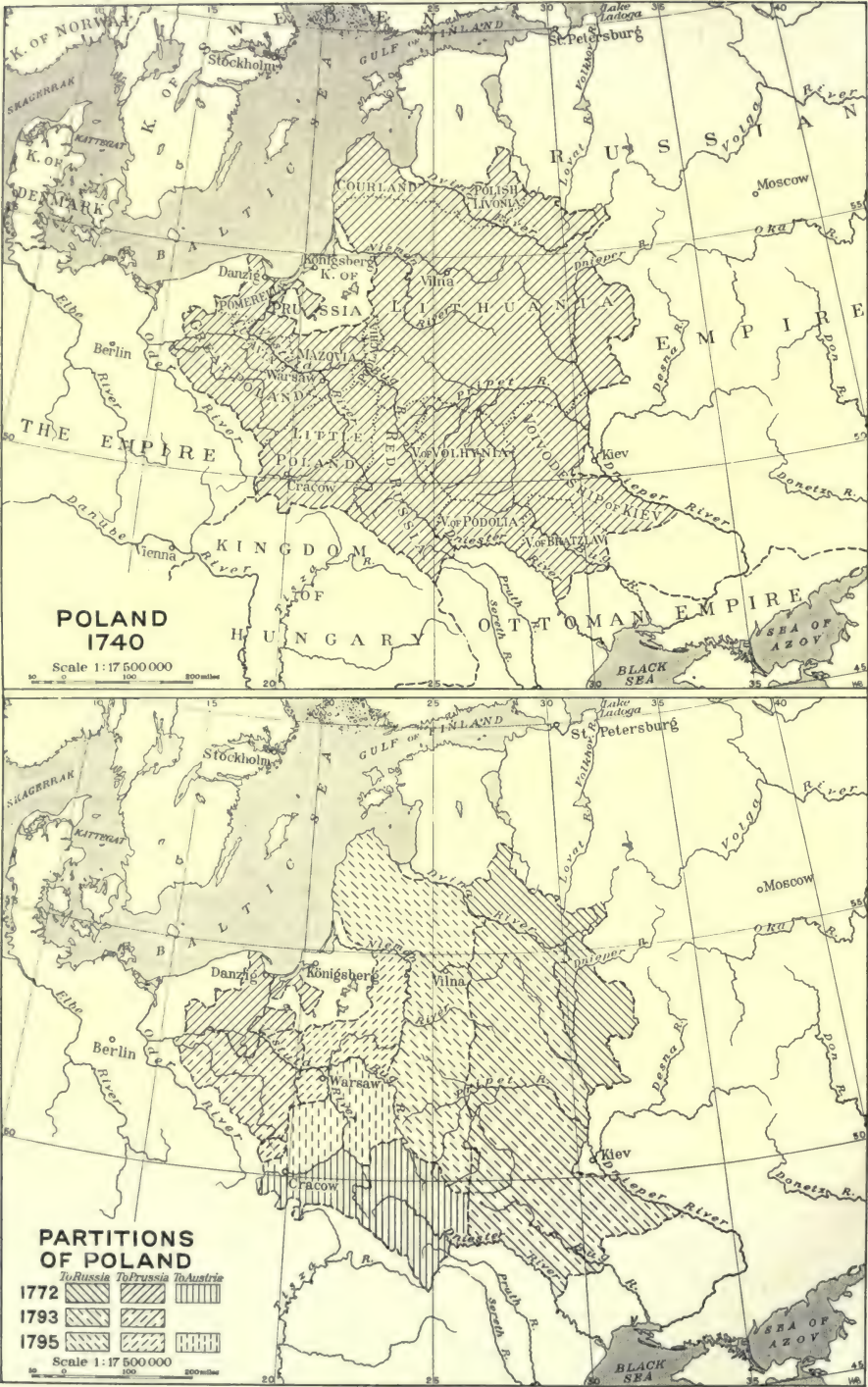


FIG. 11 (upper). Based on Shepherd, Pl. 130-131, and Droysen, Pl. 44.
FIG. 12 (lower). Based on Putzger, Pl. 25.

THE POSITION OF POLAND IN THE EUROPEAN ORGANISM

It seems all the more necessary to dwell upon the distinct physical difference between Poland and Russia, inasmuch as the conception of "Central Europe" has gained ground, especially in Germany. From such a conception it might follow that whatever is not situated in Central Europe belongs, physically, to the great uniform area of Eastern Europe. To show the discrepancy between that idea and the facts is important.

THE CONCEPTION OF CENTRAL EUROPE A POLITICAL DOCTRINE

The conception of Central Europe originated in Germany, where it became a favorite theme in German political programs. At first, Central Europe was supposed to comprise only Germany, Switzerland, and the original Austrian lands, Galicia excepted (Kirchhoff).¹⁷ Later Belgium and Holland were added, while the eastern boundary was placed at the watershed between the Oder and the Vistula (Penck).¹⁸ To this scheme of Penck, Kretschmer added Denmark.¹⁹ As the bonds of alliance between Germany and the Hapsburg monarchy grew tighter, and because of the renewed compact between the two partners constituting Austria-Hungary, the interest in southeastern Europe of the two Teutonic states was bound to increase. Central Europe, as understood by Partsch,²⁰ is a thoroughgoing expression of this interest. Partsch regards as belonging to Central Europe, Holland, Belgium, Germany, Switzerland, all of Austria-Hungary, Bosnia-Herzegovina, Montenegro, Serbia, Rumania, and Bulgaria. The extension of this term to cover the territory from the Atlantic to the Black Sea, the exclusion of Denmark and Poland, indicates the political bias of this otherwise thoroughly scientific book. German science also felt this, but could relinquish neither the idea nor its interpretation. In the meantime the danger of a conflict between Russia and Germany kept growing, and the *noli me tangere* which had been so strikingly applied heretofore to Russia's boundaries in all geographical classifications was swept aside by the course of events. Hettner²¹ added Poland to Central Europe and, in keeping with Hanslik,²² tried to fortify this by a new conception, that of "transitional Europe," which considers Poland as belonging to both Eastern and Central Europe. Finally, Banse²³ worked out an extreme definition. He simply discarded the work of the greatest German minds of the early nineteenth

¹⁷ A. Kirchhoff: *Schulgeographie und Erdkunde*, various editions.

¹⁸ A. Penck: *Physikalische Skizze von Mitteleuropa*, in "Länderkunde des Erdteils Europa," edited by A. Kirchhoff, Part I, first half, Vienna, 1887, pp. 90-113; reference on p. 94.

¹⁹ K. Kretschmer, *op. cit.*, p. 27.

²⁰ J. Partsch: *Mitteleuropa*, Gotha, 1901; also in English: *Central Europe*, in series "The Regions of the World," edited by H. J. Mackinder, Appleton, New York, 1903.

²¹ A. Hettner: *Grundzüge der Länderkunde*, 1. Band: Europa, Leipzig, 1907, p. 232.

²² E. Hanslik: *Biala, eine deutsche Stadt in Galizien*, Vienna, 1909, pp. 1-8.

²³ E. Banse: *Geographie*, with map, *Petermanns Mitt.*, Vol. 58, I, 1912, pp. 1-4, 69-74, 120-131, ref. on p. 3. See also "Illustrierte Länderkunde," edited by E. Banse, with map, Brunswick, 1914, pp. 67 and 86-87, reviewed in the Jan., 1917, *Geogr. Rev.* (Vol. 3, pp. 84-85).

century—Pallas, Büsching, Gaspari, Kant, Ritter, Berghaus, Humboldt—who had drawn the eastern frontier of Europe along the Ural,²⁴ and excluded Russia entirely from Europe, creating the conception of “Greater Siberia.” Greater Siberia is adjoined to the west by “Central Europe,” which, in the east, includes Poland and the Russian Baltic provinces, this “being proven,” as Banse puts it, “by their belonging to the sphere of German culture.”

Poland, seen in the light of such concepts, figures as the transitional ground between the two great divisions of the Old World, the West and the East. A mass of literature which was to exploit and spread this view sprang up. Even a serious geologist²⁵ was found who discovered proofs of the “dualism” of Poland, one part of which belongs, like Germany, to Central Europe, and the other to—Greater Siberia!

A historian²⁶ also appeared who demonstrated that the country between the Elbe and the Vistula, and farther east, which had been the cradle of the Germans, lies in the center of Europe and is therefore good ground for German expansion. It is characteristic that, at the same time, a German linguist²⁷ set himself to the task of reviving the theory that “what we nowadays call Belgium and Northern France is old German territory” (*Ein alter deutscher Volksboden*).

But the great world war disrupted the conception of Central Europe as well as the more recent one of “transitional” Europe and “dual” Poland. *Inter arma silent musae*. Science, too, is silenced. For the most dignified voices of Germany’s scientific world²⁸ leave no doubt as to the future trend of the conception of Central Europe, for the names of the Dnieper and the Dvina have actually been mentioned as its eastern limits.

The territorial conception of Poland has been revived by the bloody struggles upon her soil. The concepts of Central Europe, of transitional Europe, and of dual Poland belong to the past: to combat them now would seem futile. This, however, does not prevent us from defining briefly Poland’s position in the physical structure of Europe.

EUROPE’S GEOLOGICAL DIVISIONS

The two most famous geologists of Europe, Suess²⁹ and De Lapparent,³⁰ have seen in Europe the features of two intrinsically different worlds: an eastern one, consisting of the Russian tableland, which, through a long course of the earth’s history, has remained unchanged; and a western one,

²⁴ E. Wisotzki: *Zeitströmungen in der Geographie*, Leipzig, 1897, Chapter VIII: Die Ostgrenze Europas.

²⁵ A. Tornquist: Feststellung des Südwestrandes des baltisch-russischen Schildes, *Schriften der phys.-ökon. Gesell. Königsberg*, Vol. 49, 1909, pp. 1-12.

²⁶ Merbach: *Slavenkriege des deutschen Volkes*, 1904.

²⁷ ———: Deutsche Orts- und Flussnamen in Belgien und Nordfrankreich, *Zeitschr. des Allgemeinen Deutschen Sprachvereins*, Dec., 1914.

²⁸ Hofmüller: Russlands Westgrenze, *Süddeutsche Monatschrift*, Feb., 1915.

²⁹ E. Suess: *Das Antlitz der Erde*, 4 vols., Vienna, 1883-1909.

³⁰ A. de Lapparent: *Leçons de géographie physique*, Paris, 3rd edition, 1907.

i.e., Western Europe, which was subjected to continual deformations. Taking into consideration the diversity of the latter, Europe may be divided structurally into the following five divisions: uniform Eastern Europe, and four practically parallel zones, the northern, or British-Scandinavian zone, that of the lowlands, that of the central mountains, and the Mediterranean zone. In the geological structure of Europe there is no room for Central Europe.

THE NATURAL FOUNDATIONS OF EUROPE'S POLITICAL DIVISIONS

In what way did this framework affect the development of nations and the formation of political divisions in the lowland and central mountain areas?

The development of great states in this region and their growth through the absorption or the consolidation of small political communities were mainly conditioned by a characteristic feature of European geography, namely, the existence of two intercontinental seas, a southern, or Roman, and a northern, or Baltic. Between the two worlds which centered about these seas lay an alpine mountain wall. The organization which controlled the breaches in this wall was in a highly favorable position. Two such gaps existed, the Gate of Toulouse, between the Pyrenees and the Alps (broadly speaking), and the Moravian Gate, between the Alps and the Carpathians. A considerable restriction of the continental mass corresponds to these gates; the Bay of Biscay comes near to the Gulf of the Lion, while the North Sea approaches the Adriatic. This increased the importance of these gateways. Still another feature enhanced these conditions: the Baltic turns north near the mouths of the Vistula and the Niemen, opposite the very region where the Black Sea, the innermost inlet of the Mediterranean, penetrates into the continental mass. Thus three isthmuses have developed in Europe: the French, the German, and the Polish.

POLAND'S ESSENTIAL PHYSICAL ELEMENTS

Poland from the first extended to the Moravian Gate. As early as the seventh century the region was politically organized. The first rays of Christianity penetrated through that gate along with Byzantine civilization. But though the Moravian Gate afforded an easy path across the Carpathians, it led up to an almost inaccessible way to the Adriatic, the passage through the rocky wilderness of the Karst. As a gateway between the northern and southern seas, the Moravian Gate could never compare, even in Roman times, with the convenient passes leading across the Alps. The Brenner Pass, especially, was superior and caused the Adriatic lands to become a region of German political expansion under the Hohenstaufen.

This insufficiency of the Moravian Gate as a southern outlet and the eastward trend of the main affluents of the Vistula undoubtedly account

for the impetus given to Poland's political expansion in the direction of the Baltic-Pontic isthmus. The position of Poland in an area unobstructed by mountains and her equipment with a system of natural valley highways are the basic physical facts which have affected Poland's political existence and development.

THE PHYSICAL FOUNDATIONS OF POLAND'S UNION WITH LITHUANIA AND RUTHENIA

It seems pertinent to close this discussion with an explanation of the causes by which Poland, rather than Lithuania or Ruthenia, became the bridge between the two seas. The ice of the glacial period never held Ruthenia in its grip, and consequently this province remained a shelter for all life, including man. Nowhere in Poland are there any remains of paleolithic culture such as are found in Ruthenia. The dawn of history greeted Ruthenian lands, and perhaps the people, earlier than it did Poland. Moreover, it was easy for Byzantine influences to stream into Ruthenia, as the channel was broad and free. Many obstacles, however, had to be overcome by the Romans before they could reach the Poland of the Piasts. Thus for centuries Ruthenia towered culturally above its neighbors, Poland and Lithuania. But in Ruthenia power to organize did not go hand in hand with culture. The reasons were many. The greater part of Ruthenia consisted of steppes. Material life therefore absorbed most of the energy of its inhabitants. Meanwhile the steppe remained open to the incursion of organized hordes. But the steppe culture of Ruthenia lacked strength for a defensive organization. Wooded Poland and Lithuania, however, were able to take the initiative in freeing and defending their countries from invasion—a normal occurrence in the steppe. Although Ruthenia brought culture to Lithuania, especially along the valley of the Dnieper, and although Lithuania remained receptive of Ruthenian culture for centuries, still it was Lithuania that furnished the impulse and took the lead in Ruthenia's political organization.

In addition internal weakness was not wanting in Ruthenia. This country, a level land of steppes, was characterized by a sameness of climate, of natural productions, and of material culture that is uncommon over so large an area. This general uniformity was one of the causes of economic dependence, a feature which was strengthened by the lack of communications. For Ruthenia lies mostly in the region known as the Pontic or Ukrainian plateau, a strongly dissected oldland from which waters flow in all directions. At the time when Poland and Lithuania, as well as the larger part of Europe, were buried under ice, the Ukrainian crest of land was gradually rising. Under this slow but steady process, the Ukraine reached an elevation of 300 to 600 feet, while its rivers cut their channels to a corresponding depth. Cut by wild and deep ravines the land became a roadless labyrinth. It is not strange that Ruthenia, though from time

to time consolidated by the will of some strong ruler into a single state, should always have relapsed, because of its lack of communications, into many independent principalities.

Totally different were the conditions determining the fusion and physiognomy of the lands belonging to Poland even as early as the time of the Piasts. During the glacial period, the ice-cap, as it receded northward across Poland, would halt from time to time; then a deluge of waters would spring forth from its margin and stream down to the North Sea and the Black Sea. This process created not only the east-and-west valleys in Poland's central zone, but also the peripheral highways of the unglaciated region.

It is not strange then that Ruthenia, linked to Lithuania by the artery of the Dnieper, submitted to her politically, even if, at first, she dominated her culturally. Nor is it strange that later cultural centers of Ruthenia, located upon the Ukrainian plateau, felt the influence of Poland. A wilderness led to the Dnieper, while the fringing ways of communication, such as the Bug, the Pripet, and the Dniester, were all part of the network of Poland's east-and-west valleys.

It is not strange, therefore, that Poland, physiographically varied, should ultimately have attained the highest degree of culture. In control of all the natural highways of Lithuania and Ruthenia, Poland was predestined to become the territorial link of these three parts of a physical unit.

THE HUDSON BAY ROUTE

By JOHN A. CORMIE

Although the Dominion of Canada is at war and has undertaken to send overseas five hundred thousand soldiers, over four hundred thousand of whom are already in uniform, and although she has manufactured vast quantities of munitions of war and has raised several hundred millions of dollars for the prosecution of the conflict, she has at the same time continued to work on a project which has great historical interest and which promises to be an important factor in the future development of the country. No more romantic undertaking can be found in the history of North America than the long and fruitless search for the Northwest Passage, a search which lured Henry Hudson from Europe for four summers in succession in the early years of the seventeenth century. After he had failed twice, his third attempt brought him to the mouth of the great river which bears his name, and the fourth carried him through the strait which posterity has called for him, out into the sea which Earl Grey called the Mediterranean of Canada and which may become the Baltic of North America. After sailing almost due south along the east shore of the bay, instead of the warm waters of the Pacific he found the marshes of James Bay, where a mutinous crew, having no vision of a new track for the world's commerce, turned him adrift in an open shallop and left him to his fate. The Gentlemen Adventurers of the Hudson's Bay Company, half a century later, followed Hudson's trail through the strait and set up their trading posts in a huge wilderness, which in these days is becoming an empire. Today the people of Canada are building the Hudson Bay Railway, a line over four hundred miles long, from The Pas, an ancient Hudson's Bay Company trading post on the Saskatchewan River, at the edge of the wheat fields of Saskatchewan and Alberta, to Port Nelson on the bay.

The first European colony in western Canada, sent out by Lord Selkirk slightly over one hundred years ago to found the Selkirk settlement on the banks of the Red River near where the city of Winnipeg now stands, sailed through Hudson Strait and Bay; and there is a well-defined opinion that the products of the western farms should follow the path of the first settlers and reach the European market by the short northern route. The steel of the new line is at the time of writing within ninety miles of the port. The greater part of the present summer will be occupied with the building of a large steel bridge over the Nelson River at Kettle Rapids, and the rails will be laid for at least half of the remaining distance before fall. Were it not for the difficulty in securing both men and supplies, trains would be running to tidewater before the end of the current year and the dream of a generation of western farmers would be realized.

When we take into account the toll which the long rail haul to the seaboard at Montreal or New York has levied on the grain growers of the West, we need not be surprised at the steady demand for the new route, which is shorter by one thousand miles than that by Montreal. It has been realized that Port Nelson is practically the same distance from Liverpool as is Montreal, and that a car of wheat on its way to Europe from Regina could be at the port by the time it would have reached Fort William by the other system. Thus the saving is the thousand miles between Fort William and Montreal by rail or the very much longer distance and the double handling of the lake route. From central Saskatchewan and northern Alberta and the new settlements which will undoubtedly be formed still farther north, as, for instance, the Peace River settlements which are already begun, the saving in mileage will be much greater. A glance at the map will show that the benefits which will accrue to the farmers of western Canada with the development of this short road to Europe will be enjoyed by their neighbors in the Western States. The grain country tributary to the Great Northern Railway is several hundred miles nearer Europe by way of Port Nelson than by way of New York.

If one of the results of the war should be the realization of the expectations held by many public men of the Dominion, there will be a very large and rapid increase in the population of the prairie provinces. Principal Oliver, a widely known educator of Saskatchewan, said in a recently published address, "Europe with her war debts, with crippled and disorganized industries, will not be the Europe that but yesterday flaunted the glories of its riches in the face of the whole world. If we had a flood of immigration when Clifford Sifton opened the sluice gates, now will come an avalanche." Lord Shaughnessy, of the Canadian Pacific Railway, has recently given his opinion that, though "bleeding with sacrifice and bending with every effort on behalf of the great Empire of which she is an integral part, Canada's biggest rôle in the play of nations is not now but in the future. Its population is not a fraction of what it should be, of what it is capable of becoming, and of what it will be after the war." Ex-President Taft's remark that "the country is still hardly scratched" is particularly true of the area lying immediately tributary to the Hudson Bay Railway. With the coming of more people, there will be, of course, greatly increased production.

The congestion in the grain elevators and on the railroads ever since the fall of 1915, when western Canada produced the record crop of over three hundred million bushels of wheat, is another condition that must be taken into account in connection with the Hudson Bay route project. With increased population and enlarged crop acreage, the record of 1915 will before many years be far below the average annual yield. The farmers of the West, to use their own phrase, are "getting into cattle." Mixed farming with rotation of crops is now a necessity in the older districts. The

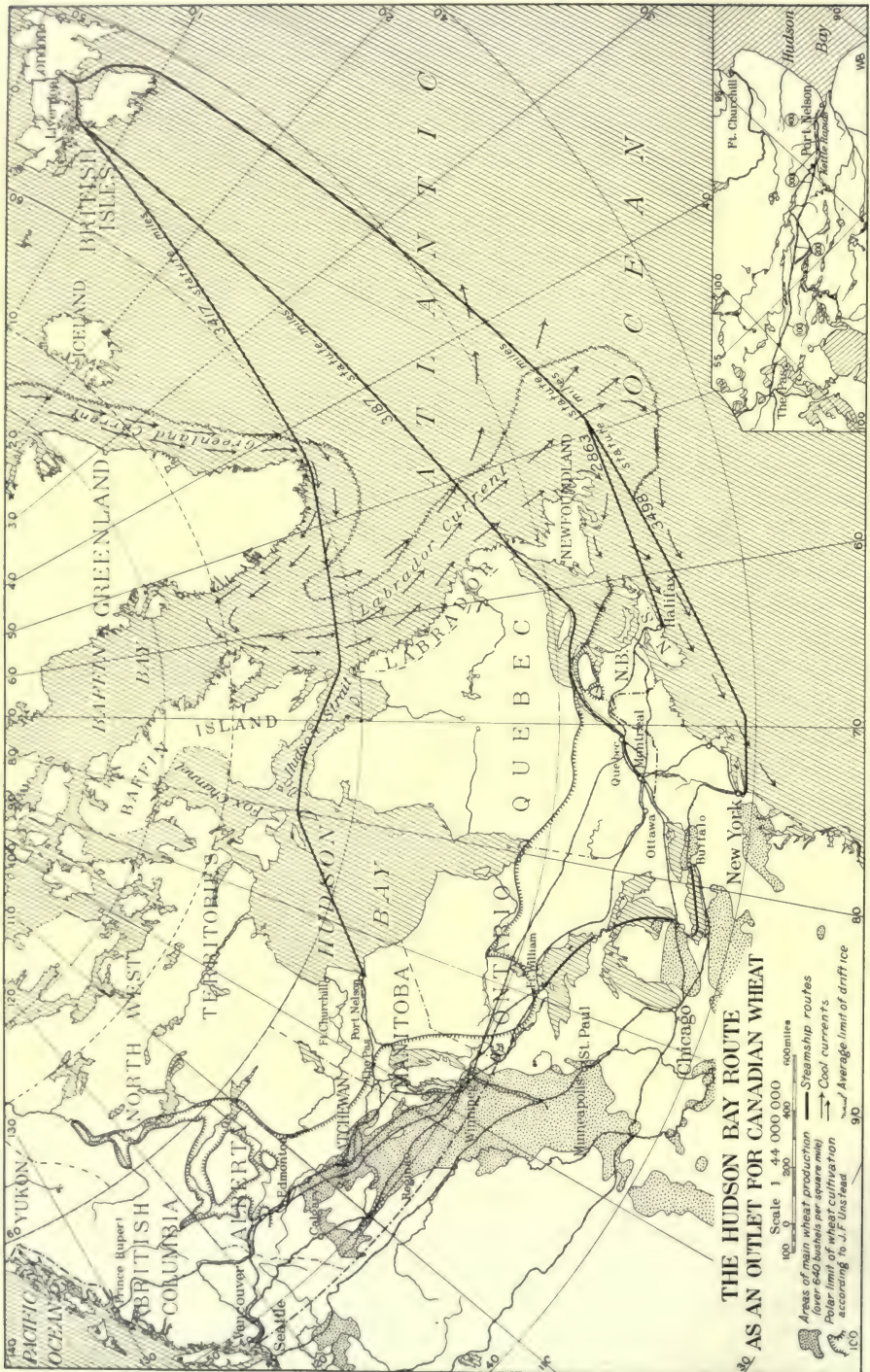


FIG. 1a.—The Hudson Bay route as an outlet for Canadian wheat. Scale, 1:44,000,000. The inset, 1:16,000,000, shows the Hudson Bay Railway. Areas of wheat production based, for the United States, on the atlases of the Twelfth and Thirtieth Censuses of the United States, 1903 and 1914; for Canada, on the cereal maps of Alberta, Saskatchewan, and Manitoba, published by the Railway Lands Branch, Department of the Interior, Ottawa, 1915. Limit of wheat cultivation according to map accompanying a paper by J. F. Unstead in *Geogr. Journ.*, Vol. 39, 1912.

northern sections of the provinces, with their greater yields of natural hay and the protection afforded by larger forest areas, together with the fact that a short haul of two or three days will bring cattle to tidewater, will more quickly develop mixed farming.

The cost of transporting farm products is now so great that it is declared by agricultural authorities to be the chief cause of the relatively low returns to the industry. This disadvantage increases as settlement proceeds farther north and west. It burns the farmer's candle at both ends, giving him lower prices for his products and increasing the cost of all the commodities he purchases.

These three considerations, the reduction of one thousand miles of rail haul in the distance that now separates the granaries of the West from the Liverpool warerooms, with consequent lowering of the cost of transportation both ways, the prospect of large and rapid expansion in volume of production, and the demands made upon the railway facilities by the present agricultural output, make out the case for the Hudson Bay route, provided there be no insuperable obstacles to its construction and operation.

That there have been and are obstacles in the way of the project is beyond question, but it appears to be equally beyond doubt that they are not insuperable. Perhaps the chief hindrance to the advancement of the work in the past has been the attitude of the great trading companies, notably of the Hudson's Bay Company, to which was given in 1670, by King Charles of England, a monopoly in trade for all future time over all the northwestern part of North America, and whose interest it was to preserve their trading and trapping grounds from the incoming of the white settler. A thick cloud of darkness was accordingly spread over all their territory. This was broken first in Oregon, and the operations of the Adventurers of England have been gradually forced back by incoming settlement, until now the only territory left lies north of the Saskatchewan River. Reputed inhospitable climate and alleged barren soil have been urged as an objection to permanent settlement in districts where today there are thriving communities. Investigation has disclosed the fact that the climate of Manitoba, four hundred miles north of the international boundary, on account of the absence of windswept plains and because of the proximity to the waters of Hudson Bay, the temperature of which is slightly higher than that of Lake Superior, is more endurable than that of Winnipeg. Cultivated strawberries have been matured in The Pas, the southern terminus of the road, and all ordinary vegetables are grown with success at points along the line as far as Port Nelson. Happily the plains of western Canada are now known to be fit habitation for others than Indians and buffaloes, and, in time, the darkness will lift from the great areas north of the prairies.

A second difficulty encountered in building the road was the absence of authoritative maps of the district through which the road was to be

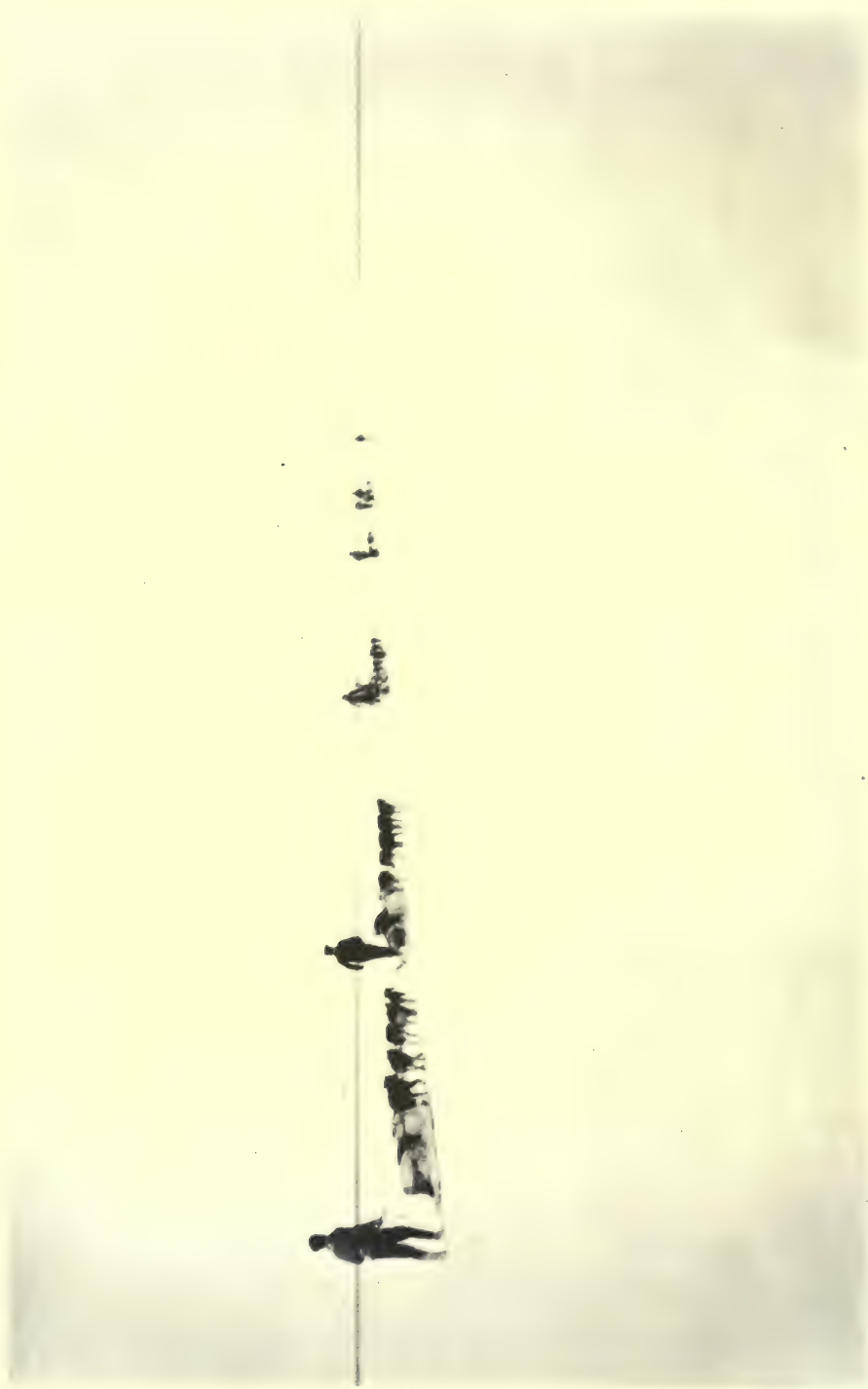


FIG. 1—Hudson Bay Railway survey party moving camp in winter.

built. Apart from a knowledge of the general courses of the Churchill, Nelson, and other larger rivers, there was no reliable information, and knowledge of the details of these river courses was vague. Along the line there are many lakes, but nothing was known of most of them until the surveyors went in to locate the railway, and knowledge of the general topography of the country was in an equally vague state. While the preliminary survey of the railway was difficult and costly, valuable additions have been made to our geographical knowledge of the Dominion.

The lack of settlements along the proposed line was a further difficulty. Apart from groups of Indians, widely separated, with an occasional trading post and mission, there was no settlement and no mode of access but the canoe in summer and the dog train in winter. The railway builders had to pierce this unsettled land, carrying along, with their building material, all supplies of food and fodder for an army of workmen and their animals. The road could not be built in sections, as was done with the recently built National Transcontinental Railway of Canada. It had to be pushed out mile upon mile from the south.

Perhaps the greatest of all the difficulties that lay in the path of the enterprise was the antagonism of influential eastern interests who have the ear of both political parties and have used their influence to prevent the beginning of the work and are today attempting to delay construction, some, indeed, advocating the entire abandonment of the project. A Toronto weekly with a considerable circulation remarked, when the call came for railway iron for the battlefields, that the Hudson Bay Railway might now justify its existence by tearing up its steel and shipping it to France. Some months ago the *Toronto Globe* said: "The opinion among competent judges is that the Hudson Bay Railway is the biggest sink-hole into which the money of the people of Canada has ever been put." This reminds one that the late Alexander Mackenzie objected to the building of the Canadian Pacific Railway on the ground that it would not pay for its axle grease. Happily for the Hudson Bay Railway, as well as for some other matters, the people of the West have reached a point of political influence where they can no longer be ignored, and opposition in other parts of the country cannot prevent the route from being put into operation. The *Manitoba Free Press* replied to the *Globe* by saying: "Malevolent eastern interests may delay but they cannot defeat this great national project, designed to free, to some extent, the western wealth producer from his eastern financial master."

The building of a harbor at the mouth of the Nelson River has not been easy. The drainage basin of the Nelson includes all of the Canadian prairies, the Red River valley in the United States, and Ontario up to a point seventy miles west of Fort William. This means that the Nelson is a very large river. It carries down great quantities of silt, which are deposited at the mouth of the channel, creating extensive sand bars and an

unstable river bottom which will require constant dredging. Although the port will be situated near the fifty-seventh parallel, the large body of water, meeting a tide which rises fifteen feet, keeps part of the mouth of the river permanently free of ice, and on part ice forms to a thickness of not more than ten inches. The controversy over the selection of the mouth of the Nelson as terminal in preference to that of the Churchill appears to be settled. The Churchill has the advantage of a ready-made rock-bound natural harbor of limited dimensions. Its disadvantages are that it necessitated the building of eighty more miles of railroad and would have required a fourth train division, and that over a heavy grade. In the profile maps of the proposed locations, the summit on the Nelson line occurs at Mile 51, and is 920 feet above sea level, or 70 feet above the level of the terminal at The Pas, and from that point down to the sea there is a uniformly level slope. The Churchill route leaves the Nelson route at Mile 102, slopes down to 575 feet but reaches 789 feet at Mile 298 and has several heavy grades between that and the sea. The shipping season will be a little longer at Port Nelson than at Fort Churchill, and there is an unlimited area for a harbor. The cost of maintenance will be more than made up in the difference between the cost of operating a railway on the southern location and that of operating one on the bank of the Churchill River. An island is being built in the deep water at the mouth of the Nelson which will be reached by a steel bridge, and, while engineering mistakes appear to have been made, the experimental stage is past, the most difficult work is done, and the building of a substantial dock is now only a matter of time.¹

Is Hudson Strait navigable? A railway can be built from the wheat-fields to the bay, the mouth of the Nelson can be converted into a commodious harbor which the largest ocean-going boats can enter, but can the strait be navigated for a period each year sufficiently long to justify the attempt to operate the northern route? On the answer to that question hinges the whole problem. Hudson Strait is a body of water about four hundred and fifty miles long, in width varying from fifty miles to two hundred miles, through which the ice-drifts from Fox Channel pass out into the Atlantic. Through this strait all traffic to and from Port Nelson must pass, and, although the port is six hundred miles from the western end of the channel, its importance as a sea port is absolutely determined by the length of time each year navigation can be safely carried on through the strait.

That the strait is navigable no one disputes. Who penetrated it first is not known, but it is known that Henry Hudson, with a poor little tub of a boat and a mutinous crew, sailed into the bay on August 4, 1610, and that the crew, after casting their master adrift the next summer, went out

¹ For views of Port Nelson and its pier see Fig. 8, p. 444, in the December, 1916, *Geogr. Rev.*, and the illustrations accompanying E. W. Gage: The Hudson Bay Railroad, *Scientific American*, April 28, 1917, pp. 418-419.—EDIT. NOTE.

through the strait and reached home that same year. The following year Admiral Button was sent out by the British Government to search for the lost adventurer. He reached the Nelson River, wintered there, named the port after his first mate, who died during the winter, and returned to England in 1613 to report finding no trace of Hudson. In 1615 William Baffin, whose name lives in Baffin Island, penetrated the strait and was in the open water of the bay on July 3. The Hudson's Bay Company boats have used this northern route to reach their fur posts for two centuries. If these early navigators in an unknown sea, with all the handicaps of little sailing vessels, could safely sail these northern waters, what may not be done with charts, lights, the extension of the wireless system from Port Nelson, a flotilla of ice breakers, and modern steam-driven and steel-clad boats? In 1915 thirty-six passages are known to have been made without mishap.

In regard to the length of time during each summer that navigation is possible, the opponents and friends of the project must content themselves with opinions. There is general agreement that for four months of the year, including August, September, and October, with parts of July and November, the strait can be safely sailed. The late Admiral Markham, who, with Commander Gordon, in 1886, made an investigation, the report² of which has never been superseded, said: "It is almost impossible, until more is known of the movements of the ice in the strait, to allot any fixed period. From the general information I have acquired from various sources more or less trustworthy, combined with my own experience, I am prone to believe that Hudson's Strait would be found navigable for at least four months every year, and probably often for five or six months. There will, I have no doubt, be many years when navigation can be carried on safely and surely from the first of June to the end of November." In 1907 an investigation was made by a select committee of the Senate of Canada, on "the navigability of Hudson Bay and Hudson Strait, as an alternative means of communication with the northwestern regions of Canada," since published in a report entitled "Canada's Fertile Northland,"³ and evidence was taken from men competent to express opinions on the subject. Mr. A. P. Low, the then Director of the Geological Survey of Canada, said⁴: "The strait is navigable from about the middle of July until the first day of November anyway, and a couple of weeks might be

² Report of the Hudson's Bay Expedition of 1886, under the command of Lieut. A. R. Gordon, R.N., 131 pp., Dept. of Marine, Ottawa, 1886.

See also A. H. Markham: Hudson's Bay and Strait, *Royal Geogr. Soc. Suppl. Papers*, Vol. 2, 1889, pp. 617-660; and *idem*: Hudson's Bay and Hudson's Strait as a Navigable Channel, *Proc. Roy. Geogr. Soc.*, Vol. 10, 1888, pp. 549-567 [an abstract of the previous item].

³ Canada's Fertile Northland, A Glimpse of the Enormous Resources of Part of the Unexplored Regions of the Dominion: Evidence Heard before a Select Committee of the Senate of Canada during the Parliamentary Session of 1906-7, and the Report Based Thereon, edited by Captain Ernest J. Chambers. 139 pp. and separate pocket of maps., [Dept. of the Interior], Ottawa, 1907 (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 40, 1908, pp. 758-759).

⁴ *Ibid.*, p. 112.



FIG. 2.



FIG. 3.

FIG. 2—Mile 45, Hudson Bay Railway, looking northeast.

FIG. 3—Bridge over the Nelson River at Manitou Rapids (Mile 242).



FIG. 4.



FIG. 5.

FIG. 4—Western channel of White Mud Falls, Nelson River. Available horsepower of falls, 300,000.

FIG. 5—Portaging canoe, Long Spruce Rapids, lower Nelson River. Note prairie lands.

added at the end, because the ice in Hudson Bay, the new ice, is of no consequence to a ship until it gets to be 15 or 18 inches thick, and not much ice forms before that date." Altogether Mr. Low considered the Hudson Bay route, when it was clear, an even clearer one than the St. Lawrence. There are at least two months when there is no trouble from ice at all. Dr. Robert Bell of the Geological Survey also appeared before the select committee and said⁵ that all his trips through the strait were between June 22 and about October 10, and he expressed the opinion that the strait is navigable between these two dates. Dr. Bell said⁶ he "did not know any more desirable piece of navigation in the world, excepting the middle of the ocean, and even then a common sailor, who could not take an astronomical observation, could sail through the straits with perfect safety. That was what Henry Hudson's men did after putting him and part of the crew into an open boat and leaving them behind." He was further of the opinion that ocean-going vessels would be suitable for navigation in Hudson Bay and Strait, but in the winter it might be all the better if the ships were protected. Similar testimony in very imposing volume, some more favorable, some less so, is available. The success of Canadian ice-breakers at Archangel has helped to increase confidence in this northern route.

In estimating the value of this new line of communication, it must be borne in mind that, even at the present rate of production, the crop is never out of the country the year it is harvested. Mr. Gutelius, the superintendent of the Canadian Government Railways, estimated that it would take the railways two hundred days to move the crop of 1915. This estimate was unduly optimistic, for part of the 1915 crop was still in the country when the 1916 crop began to come upon the market. With so short a crop as that of 1916, it was estimated that on April 5, 1917, there were still approximately 25,000,000 bushels of wheat in the province of Alberta, 35,000,000 bushels in Saskatchewan, and 12,000,000 bushels in Manitoba. This grain will still be moving east at the time the Hudson Bay Railway opens. Abnormal shipping conditions created by the war must be taken into account, but, as population increases, a smaller proportion of every crop will be shipped out the year of its production. Taking the three western provinces, a comparison of the yearly production of wheat and oats in bushels is shown by means of the accompanying table, published in the *Bankers Magazine* (New York)⁷:

	<i>Wheat</i>	<i>Oats</i>		<i>Wheat</i>	<i>Oats</i>
1907.....	70,922,584	74,513,000	1912.....	196,000,000	224,500,000
1908.....	96,863,689	108,987,000	1913.....	188,878,000	208,308,000
1909.....	119,200,000	163,998,000	1914.....	134,445,000	150,474,000
1910.....	101,236,000	108,301,000	1915.....	370,000,000	305,680,000
1911.....	169,725,000	185,570,000	1916.....	160,000,000	232,409,000

Consideration must also be given to the fact that the country buys as well as sells, and that the payment of the heavy cost of rail haul to the

⁵ *Op. cit.*, p. 117.

⁶ *Ibid.*, p. 119.

⁷ March, 1917, p. 265.

stations on the prairies is made by the purchaser. If farm products can be shipped out via Port Nelson and the strait, commodities can be brought in over the same route—must, indeed, be brought in if the project is to be a commercial success. Coal, for instance, as any one living in the Northwest knows, is an important part of the necessities of life. Mr. M. J. Butler, formerly chief engineer of the Department of Railways and Canals of the Dominion Government, said in his report on this route: "I believe it is practical to lay down coal at Port Nelson from Nova Scotia at a cost not exceeding \$3.75 per ton. The rail haul to Saskatoon, as an average point of distribution, need not exceed \$4.00 per ton, making the cost \$7.75 per ton."

What of the country through which the road is being built? Is there a future for New Manitoba which would justify the construction of this line, apart from overseas shipping?

The oldest industry is, of course, that of the trapper. An army of trappers bring into The Pas, the commercial center of the district, an annual catch of fine fur to the value of \$250,000. The manager of the Hudson's Bay Company post at this point, in the days before the railway brought competition, has bought as many as 250,000 musk-rat pelts. All the fine furs, beaver, otter, mink, silver, black, red, and white foxes, are taken in large quantities, and at least two men have begun the industry of breeding silver foxes. The fishing industry, carried on during the winter, has reached considerable dimensions, the catch, consisting of whitefish, lake trout, and pickerel, for the season amounting now to about one thousand tons. Permission was given in 1916 to take sturgeon from the lakes. Owing probably to the clear, cold water of the northern lakes, these fish are not excelled. Considerable areas are covered with spruce, and a beginning of the lumber industry has been made by the Finger Lumber Company, which has established a plant at an outlay of one million dollars, with a daily cut of 200,000 feet of lumber. The amount of pulp-wood has not been estimated, but there are apparently vast quantities of such wood. During the past year much attention has been paid to the discovery of mineral-bearing rocks in the western flange of the "Great Canadian Shield" over which the railway runs. In northern Manitoba these rocks cover an area approximately 140 miles in length and 25 miles in width. Near Mile 86 on the railway gold has been discovered, and mining operations have been begun on three claims. The ore is gold-bearing quartz, and the first car recently shipped out, which was in the nature of a test, was treated in Trail, British Columbia, and the returns are said to be satisfactory. Farther east than the goldfields, at a point almost on the boundary between Manitoba and Saskatchewan, copper ore has been discovered in two bodies, one of which is very large. Operations have been begun on the smaller of these bodies, and during the past winter 3,600 tons of ore have been taken out. This ore contains 22 per cent of copper, and there are also iron

and some zinc. On the larger of these bodies of copper ore the work of drilling, with a view to determining its size, has been carried on for several months. It is not possible to say more about the mineral outlook of the country, for the reason that there has been little prospecting, but the rocks are of the same geological age as those at Cobalt and Sudbury in Ontario, and mining engineers have said that the future of the mining industry of New Manitoba is very bright indeed. Power from many rapids and waterfalls may play a large part in the development of this industry.

Is there an agricultural future for the district? For the first ninety miles of the railway line, the country is low and swampy and covered with moss. Under the moss is heavy clay, carrying many glacial boulders. Nothing can be done with this land until it is drained, and it is doubtful if much of it can be drained. For fifty or sixty miles farther the country is rocky, and what soil there is, is too shallow to be of any use. Beyond this, the railway enters the so-called "clay belt," indicated on the map of the Geological Survey as containing about 10,000 square miles. Many opinions have been given as to the value of this land for agricultural purposes. Mr. J. B. Tyrrell, a witness before the Select Committee referred to above, expressed the opinion⁸ that there is "a magnificent stretch of country there and it extends westward along the Churchill. These lands north of Lake Winnipeg are clay lands, an extension of the same basin as the Manitoba clays." Mr. Tyrrell said he believed that that country, while a little harder to be settled, and not so productive to settlers who are looking for farms ready-made and cleared for them and ready for planting to wheat, will be as fine an agricultural tract of land as there is in the north-west. Mr. William McInnes, geologist of the Geological Survey, said⁹ that "after leaving Split Lake, ascending the river, this clay-covered country shows absolutely no boulders and no gravel. . . . There is absolutely nothing to interfere with the cultivation of the soil there. It is a country that has been burnt over. . . . It has been subject to repeated burns. At the present time, it is covered by a very open forest. Grasses grow fairly luxuriant." Mr. McInnes said he did not mean to say that all of that 10,000 square miles was good land, but the basin characterized by this deposit of clay has an area of about the size mentioned. During the summer of 1910 an inspection of timber was made by J. R. Dickson, Assistant Inspector of Dominion Forest Reserves, along the proposed line of the Hudson Bay Railway. He traversed part of the clay belt and reported¹⁰ that it "contains upon the whole from 50 per cent to 75 per cent of arable land and probably has a good agricultural future. The soil is exactly similar to that around Cochrane in New Ontario, which yields such

⁸ *Op. cit.*, p. 90.

⁹ *Ibid.*, p. 65.

¹⁰ J. R. Dickson: Report on Timber Conditions, etc., along the Proposed Route of the Hudson Bay Railroad, *Forestry Branch Bull.* 17, 27 pp., Dept. of the Interior, Ottawa, 1911.

large returns under right treatment." In order to make a practical test of the climatic and soil conditions of this land, the Department of Agriculture of Manitoba, in the spring of the current year, opened up a small experimental plot, no returns of which have come to hand. While it is true that there are gardens wherever there are permanent residents, at Hudson Bay's Company posts and missions there is no farming, and it remains to be seen whether or not the greater proximity to tidewater will give these lands a value that will make them rivals to the more open lands on the prairies, of which there are still vast quantities unoccupied. Dr. John McDougall, quoted by Major Chambers in "The Unexploited West,"¹¹ says the district, "though wooded to a considerable degree, is a far more enticing agricultural proposition than that which faced the early settlers on the bush farms of Ontario and the eastern provinces fifty years ago." The day will undoubtedly come when a large agricultural community will be found in New Manitoba.

Apart from the possibilities of agricultural development in New Manitoba, created by the successful operation of the Hudson Bay Railway, there is a large territory in Saskatchewan lying north of the great river which has given its name to the province and a still larger area along the upper stretches of the Peace and Mackenzie Rivers, where development is retarded by the lack of easy communication with the world's markets. Mr. Tyrrell, speaking of means of communication with the Peace River country, said: "If the Hudson Bay route was opened, it would be very much better than that—shipping to the European markets via Pacific ports. It would be very much shorter and a great deal of time would be saved. The people of Athabaska would be as much on the front as they are at Fort William."

Taking a very much larger view of the problems of communication and examining the broad question of the transportation of the world's supplies, it may be held that Hudson *did* make the great discovery. He was searching for a short route from England to the rich markets of China, and he died somewhere along the shores of the bay in disappointment at the apparent failure of his quest. He may not have failed. From England to eastern Asia via Suez is a distance of about 16,000 miles. By way of New York and San Francisco it is about 11,000 and by way of Seattle or Vancouver about 10,000, but by way of Port Nelson and Prince Rupert it is less than 8,000, and, to use the language of the North, "the portage" from Port Nelson to Prince Rupert is much shorter than that on either of the other systems. Posterity may credit Henry Hudson with success.

Comparison of the cost of building the railway with that of other enterprises to which the Canadians have set their hand should be made. The

¹¹ The Unexploited West: A Compilation of All of the Authentic Information Available at the Present Time as to the Natural Resources of the Unexploited Regions of Northern Canada, by Major Ernest J. Chambers. 361 and xxxiv pp., [Dept. of the Interior], Ottawa, 1914. Reference on p. 37.

St. Lawrence channel has cost the Dominion Government about \$38,000,000. A harbor is being built at Toronto at an expenditure of \$20,000,000, and the reconstruction under way of the Welland ship canal will cost \$50,000,000. The estimated cost of the Hudson Bay Railway, including the terminals at The Pas and Port Nelson, is \$26,000,000. If for four months each year the transportation of the western crop can be expedited by having the distance to Europe reduced by one thousand miles, it is probable that the grain growers will insist that no obstacles be placed in the way of an early completion of the line. "Nothing but an actual test will ever prove which opinion about the northern route is right. The believers in the route await that test with absolute confidence."

NATURE AND MAN IN EASTERN PARÁ, BRAZIL

By EMILIE SNETHLAGE

Museu Goeldi, Pará

Colonel Roosevelt's remarkable and hazardous journey in 1914 brought home to many a realization of the fact that large expanses of territory in South America are still unknown. Among these the largest are in the Amazon Basin; and, strange to say, they are located in the middle and lower rather than in the upper sections of the basin. The reason is that the upper part of the basin is a vast lowland in which the rivers flow with little change in gradient and are navigable for steamers or launches almost up to their headwaters, where there is connection, by well-known trails, to the dense populations of the Andean plateaus and the trade routes of the Pacific. By contrast the lowland area in the lower, or eastern, part of the basin is restricted by the close approach of the Guiana and Brazilian Highlands, which leave only the extreme lower courses of the tributaries of the Amazon open to steam navigation, while their upper courses are interrupted by rapids and falls. Many of the main rivers have been visited by scientific explorers only within the last twenty-five or thirty years: in the north, the Trombetas by Coudreau in 1899, and the Jary and the Parú by Crevaux in 1877-79; in the south, the Tapajoz by Coudreau in 1895-96, the Xingú by von den Steinen in 1884, and the Araguaya and Tocantins by Ehrenreich in 1888. But the spaces between the rivers have remained to a great extent *terra incognita*. The cross-country exploration of Farabee¹ in the hinterland of British Guiana and between the Tapajoz and the Xingú is the latest piece of pioneer exploration in eastern South America and is worthy of comparison with the best of the earlier expeditions.

A good illustration of how little is known about the interior of northern Brazil even near centers of population is the region immediately to the east of Belem, or Pará, a city of more than 100,000 inhabitants, the terminus of the only railway in the state of Pará, and a sea-port of the first rank, where the trade and navigation of the whole enormous Amazon Basin are concentrated. We have frequently been asked by naturalists, who were in receipt of botanical or zoölogical specimens from this region, about the location of the places mentioned on the labels of the specimens, "because we cannot find them on any map." In fact, though some of these places are quite considerable, not even the official map of the state, re-edited at great cost in 1908, shows them. Take for instance the region east of Pará, traversed by the Pará-Bragança railway. Not even the names of all the stations are given. The coast is the region best known and in consequence

¹ See the February *Review* (Vol. 3, 1917), p. 149.—EDIT. NOTE.

best represented. Nearly all the small coastal rivers have their courses fairly well marked. To the south, however, the map is less explicit. The names are also given of the larger affluents of the Guamá, the main artery draining the hinterland, but as to the tributaries, only a few of which are delineated, the map becomes silent; and with the exception of the small cities and market-places on the coast, some of the railway stations, and about half a dozen *povações* on the Guamá and the Caeté, the name of no locality is given. Yet the region between the coast and the Guamá, divided by the railway into two parts of about equal size, is fairly well populated and is considered to be one of the most advanced and best cultivated of the state. It is interesting in many respects to the scientist also, forming, so to speak, a compound of nearly all the most important features, ethnographical as well as geographical, of Amazonia. Besides persons of mixed descent, of all shades and colors, full-blooded representatives of each of the principal three races that make the modern Brazilian are quite commonly seen, and in remote places representatives of the Indian component are still living in their old haunts.

Even now by far the greater part of the country is covered with majestic and interminable virgin forests. It contains, however, vast *campos* in its eastern part, where stock-raising flourishes. Near the coast and along the larger rivers one meets large wooded swamps, *igapós*, while away from the latter the gradually rising land, the never swampy *terra firme*, occasionally even forms insignificant hills and ridges.

To the naturalist the difference between the highland forest, the *matta virgem da terra firme*, and the swamp woods, the *igapó* (of which the *várzea*, the country swampy in winter only, is an important variety) is of great significance, and it is my conviction, after a ten years' stay in the country, that it serves even better than the more generally known difference between forest and *campos* to elucidate the question of local races and geographical subspecies in the animal world.

If you take the train at Belem for Bragança, you will not see much of the virgin forest, at least in the first half of the 180-mile journey, and nothing at all of the *campos*. For in the beginning the railroad is bordered principally by *capoeira* and only occasionally passes through insignificant patches of wood, *igapó* most of it, near the rivers. The *capoeira*, appearing generally as a sort of low, extremely tangled shrubwood, invades the abandoned *roças* (plantations) in a very short time, the latter being cultivated, after the Brazilian fashion, for several years only, or as long as the soil retains its natural fertility. Then the impoverished land is left to itself and produces a characteristic shrub-vegetation, presenting in its dwarfed and somewhat meager though tangled appearance the greatest imaginable contrast to the giant, majestic growth of the *matta virgem da terra firme* or the tropical exuberance of the *igapó*. In these *capoeira*-covered stretches the plantations themselves no longer play a conspicuous part, as was the



FIG. 1.



FIG. 2.

FIG. 1—The Franciscan mission of São Antonio do Prata, about one hundred miles distant from Pará, Brazil. (Photo by E. Snethlage.)

FIG. 2—Hut of a half-breed Indian hidden among banana trees. (Photo by E. Snethlage.)

case ten years ago, the land near the railroad having been cultivated first and being now abandoned and overgrown with shrubs.

From the station Igarapé-assú onward—about halfway between Pará and Bragança—the country takes on a more picturesque look, the road leading alternately through *terra firme* and extensive swamps, both richly wooded. The *campos* remain hidden to the left. They are most extensive on both sides of the little coast river Quatipurú, but separated from the railway by a girdle of forest land of more or less considerable width. They are interrupted by wooded stretches of land, called *tesos*, and by gallery-woods bordering the rivers, representing a special forest-formation, related, however, to the *igapó*.

I wish, however, to introduce the reader to the typical virgin forest, and so we leave the train at Igarapé-assú and turn southward to the watershed between the coast rivers and the affluents of the Guamá, whose headwaters intermingle in a very complicated and curious way. About 12 miles to the south, at the confluence of the Maracanã, one of the more considerable coast rivers, and the Rio do Prata (which is not to be found on any map), an Indian mission was founded some twenty years ago by devoted and hard-working Franciscan monks and nuns of the order of Santa Clara. The tribe whose conversion was to be undertaken is a branch of the Tembé Indians, who though remote from the settlements of white men had lived in quite good relations with them for some generations, as their semi-barbarian kindred in the Capim and Guamá districts do even to this day. The mission, however, soon also became the center of a considerable colony of Cearenses, inhabitants of the state of Ceará, who had fled from that terrible scourge, the *secca*, or drought, so impressively described by Herbert H. Smith.² The mission and colony of São Antonio do Prata, as it is called, presents quite an agreeable aspect, with its little church in the Italian style (the monks are most of them Italians, while the nuns are all of Brazilian descent), its stately convent, and the attractive building which the monks constructed for themselves only a few years ago. The erection of the buildings is in fact all their own work, as is the laying-out of the fields and the cultivation of many of the plantations and orchards. In recent years the mission, like all enterprises in Amazonia, has suffered considerably from the rubber crisis, though the government subsidizes the institution and does its best to help the devoted monks to get on with their useful educational work. The mission now serves partly as an orphanage; more than sixty children are being educated there, the number having been much larger formerly.

When I first came to Prata, ten years ago, the nuns' house had only just been finished. Services were held in one of its rooms, and the monks lived with their pupils in rather primitive sheds. Large and beautifully kept plantations surrounded the place on all sides, and there was a hopeful and

² Brazil: The Amazons and the Coast, Scribner, New York, 1879: Chapter XIII, "Ceará and the Drought."

prosperous look about everything. Now the new and stately buildings of the church and monastery rise from the middle of the *capóeira*, the former plantations having long since been abandoned. This gives the place a somewhat desolate appearance at first, well in accord with the nearly universal depression caused by the crisis. Yet, on close examination, the case of São Antonio do Prata is not at all hopeless, and I trust it may prove to be a first instance of the better future that awaits the Amazonian region when the crisis has passed. Following the newly laid-out roads, lined in part with beautiful, shady mango trees, we come, after a quarter or half an hour's walk, to the new plantations, and find that, beside the old inhabitants, a number of new agricultural colonists have settled there, each having built his *barraca* (hut), in the middle of a large, newly planted *roça*. Rice, Indian corn, sugar-cane, beans, etc., are producing rich crops, which are brought to market by means of a small field-railway, constructed by the monks, but now run by the government as a branch of the E. F. B. (Estrada de Ferro de Bragança).

The virgin forest, which some years ago still surrounded the place quite closely, has now retreated a good deal. To the northwest, where the *igapó* of the Rio do Prata and the hills of the watershed make farming impossible, the forest may be reached in a twenty-minute walk, and from there it stretches away almost indefinitely, covering hills and valleys with its deep green shade. Wandering, as we safely may, thanks to the compass we have with us, the whole day long under its leafy vault, we are impressed anew with wonder at the enormous expanse of the Amazon forest. Weeks and months may be spent in this same interminable woodland, on the banks of the Tocantins, and in the region between the Xingú and the Madeira, from which its green waves still sweep on to the west, surging up and covering the first chains of the Andes, only to be stopped by the bleak winds of the *páramo*.

As for scenery, the cultivated land and even the *capóeira* have their beauty, too, especially as they are generally intersected with remains of the high forest and lovely little valleys, abounding in palms and traversed by clear brooks. The picturesque *barracas* of the colonists or the indigenous Tembés are hidden under large-leaved bananas, and the crimson flowers of the beautiful hibiscus, which the *caboclos* like to plant in their little gardens, inject a vivid element into the flood of green which is the characteristic of the virgin forest as well as of the *capóeira* and the plantations.

But perhaps its loveliest sights the Amazonian forest reserves to the canoe traveler in the upper courses of the small coastal rivers or of the Guamá affluents. All the showy plants which, to the inhabitant of temperate climates, appear as the incarnation of tropical beauty and exuberance, are crowded together here. They receive just enough light to force them to arrange their foliage to the greatest advantage—which, at the same time, means greatest perfection of outward appearance, as almost always

in nature. There are delicate ferns and large-leaved aroids, spreading their brilliant green shields around the overhanging stems in the most artistic manner possible. Palms lift their graceful heads on slender stems or curve over the brown-golden waters, their feathery crowns forming the centerpiece of a bewitching picture, set off by the tangled mass of vegetation behind. Every bend of the river (and its bends are innumerable) discloses a new view of ever like, yet ever changing beauty. Animal life, apart from the tiny or noiseless creatures that escape the eye of the non-zoölogist, is not so abundant near the river banks as is the vegetation. Kingfishers of different species, noisy and showy birds, play the most conspicuous part. Flocks of parrots and parakeets settle screaming on the top of some fruit-bearing tree, and occasionally a humming-bird darts rapidly from shore to shore. The gorgeous *Topaza pella* is not at all infrequent on the Maracaná and its affluents, though it rarely appears in the full glory of its glittering array of golden green, purple, and ruby, these colors only flashing out under special conditions of light and shade. Occasionally a band of capuchin monkeys may be heard chattering in the distance, or the pretty little squirrel-monkey skips along the tree-tops bordering the banks. Sloths are to be met with, too, climbing or feeding lazily among the leaves. But nearly all the larger inhabitants of the woods, the *anta* (tapir), the wild hogs, the larger felines, etc., have disappeared long ago or become extremely shy and rare.

When the mission was founded, the region between the headwaters of the Maracaná and its affluents, the Rio do Prata and the Rio Jejú, was inhabited by Indians of the Tembê tribe, and to them in that time the work of the mission was exclusively addressed. The monks and nuns soon won the confidence of the peaceful Indians, and nearly all the principal people among them sent their children to be educated at Prata. I have often been struck, not only in this case but in others, with the response which the temperament of the Indian makes to the monotonous regularity, combined with the brilliant outward show, of Catholic religious life in such places as these. The children apparently enjoy the ever-repeated walks to church for prayer and the glorious spectacle of the mass. The altar, covered with costly embroidered linen, decked with artificial flowers and shining images and vessels, never fails to impress them. However, the children's life in the monastery is not wholly taken up by religious practices. After the regular school work, which occupies the morning, the girls are taught all sorts of house- and needlework. Under the guidance of specially trained nuns they provide for the *gallinhéiro* (poultry-yard) and the garden, where beans, Indian corn, sugar-cane, and batatas are grown. Thus their education is many-sided and practical.

It is the same with the boys. Under the monks' supervision they till the land and plant it, bring in the harvest, and help to prepare it for home consumption and market. The planting of rice—wholly neglected in Ama-

zonias for a long period, as were most of the other purely agricultural practices, in consequence of the more profitable rubber-gathering—has again been taken up here in Prata. The first modern machines for threshing and cleaning the grain were set up and worked, and thus a wholesome impulse was imparted to the whole country around. Cattle were introduced and thrive much better than in most other places, apart from the *campos*. The work of the *religiosos do Prata* has proved really advantageous to the whole region, and it is to be hoped that the relatively insignificant means for its successful continuance may always be forthcoming.

There are still a number of full-blooded or nearly unmixed Tembés living near Prata, their center being now the headwaters of the little Rio Jejú, an affluent of the upper Maracanã. In 1905, on the occasion of my first stay at Prata, I was formally invited to visit the *tushau's maloca*, which was to be reached only after many hours' walk through woods and swamps, with the help of a guide. These half-civilized Indians still cling to the thoroughly Amazonian custom of hiding the approach to their houses in a most elaborate manner, by making the footpaths nearly invisible (at least to the non-Indian eye), by introducing unexpected turnings just at the least conspicuous part of the road, and sometimes even by inserting a gap of forest, so that the exit may be found only by the initiated. The *tushau*, Capitão Joaquim Braz, received me cordially. His spacious *maloca* was thatched with palm straw, and the walls of the one perfectly closed room in the otherwise open building consisted of the same material. *Farinha*-making was just going on, and I was shown the process. The manioc root is first soaked in running water in a special recess of the little brook near the house, then peeled and triturated on a special instrument, the *raladór*. The yellowish mass resulting from this is then put into a *tipity*, a long, tightly plaited basket of palm fibers, which is slung to a beam of the roof and stretched to its utmost possibility by a stone suspended on its free end. The pressure thus produced draws out the poisonous juice still contained in the mass and helps to dry it. Several hours' roasting over a slow fire in a large metal basin with continual stirring completes the process, whose final product is the white or yellowish *farinha d'agua*, the principal and most necessary food of the Paraense, be he Indian or Brazilian. Standing for hours near the fire roasting *farinha* is no easy work in this hot climate. No wonder that the Tembés, though long accustomed to clothing, throws off every dispensable garment on this occasion—as on many others.

In recent times, and principally through the influence and example of the monks, many other cereals and vegetables have been introduced, especially rice and *feijão* (beans). To the original Tembés—who is now fast disappearing—however, the manioc field was and is the chief resource, and so it never is far from his palm-straw hut. There is a marked difference, characteristic of the racial temperament, between the surroundings of the indigenous Indian hut and of that of the Cearense colonist. The latter

likes to build his house in an open place, right in the middle of his *roça*, or in front of it, beside the road. The Indian, however, prefers to have it in the woods, making his *roça* at some distance, even on the opposite shore if he lives on a river bank. Part of the *roça* is nearly always planted with *iniam*, *batata doce* (sweet potato), *macacheira*, and other indigenous roots; and some Indian corn and sugar-cane as a rule are cultivated, the latter being pressed in a rather primitive machine, with the help of a large wooden wheel, and the juice turned to *garapa*. Bananas are scarcely ever lacking, but they are generally planted in the vicinity of the huts. They are, to my mind, among the greatest beautifiers of the tropical landscape and, with the dense crowns of the *pupunha* palms (*Guilielma speciosa*), whose orange-colored fruits are likewise edible, the large acanthus-shaped leaves of the *mamão* tree (*Carica papaya*), and the feathery *assahy* palms (*Euterpe oleracea*) near the brooklet in the background, help to make a charming picture of many an Indian home. There is besides the beautiful *miriti* palm (*Mauritia flexuosa*), whose enormous, fan-shaped leaves overhang the washing-place where the good Indian housewife cleans the family linen, in rather primitive fashion, to be sure, leaving the brunt of the work to the bleaching power of the sun.

I wonder whether the drinking of *cashiri*, that unappetizing but most general of Indian beverages, is still in vogue in any remote district among the Tembés. I have found no trace of it among these Jejú Indians. They seem to be quite a sober race, the famous *assahy* wine, drunk here as in the whole Amazonian region, containing no alcohol.

Hunting still furnishes the Tembés part of his animal food. Though the tapir has become very rare in these parts and the two species of peccary are disappearing, many a *vcado* (roe) still comes in the hunter's way, and harelike *cutias* (agutis) abound, while the rarer *pacas* and *tatús* (armadillos) form a more delicate article of fare. Even the sloth is not at all disdained by the indigenous. Fishing gives good results in many of the small rivers and is still largely practiced by means of the Indian *cacury*. Most of the river-fishes like to enter the smallest affluents, the *igarapés*, at high water. These affluents are then shut off from the main river by a deeply implanted wooden fence that cannot be passed by the returning fish, which are caught by the Indians when they want them. Small and rather shallow dugouts are used by the Tembés. They are of a more elaborate and elegant make than the *ubás* of the more western rivers, being pointed at each end, and they contrast favorably with the heavy and clumsy boats of the colonists. The rivers being shallow during the greater part of the year, these boats are generally pushed forward by means of the *vara*, a long pole, while a large paddle is used for piloting. Paddles, however, are used at high water and in winter. They are rather short, but long-bladed, as compared with the rudder and with the small round-bladed paddles used on the Amazon.

Of the domestic animals kept by the Tembés, a peculiar race of lean, short-haired dogs deserve to be mentioned first, as they are extremely noisy and sure to give the first welcome, most often in a rather hostile manner, to any stranger approaching the *maloca*. Then there are fowls and ducks and turkeys and pigs, bred from time out of mind, that is, before the mission was founded and time acquired a meaning for these children of the forest.

Clothing, too, was already known to these Indians when the monks appeared, and the national *tanga* and the pretty feather ornaments had already vanished. Instead of the bow and arrow the *musquetão*, a muzzle-loader, was in vogue (incidentally, that antiquated weapon is still beloved and preferred to the modern rifle by many a *caboclo* of the interior), and the Iron Age, with its *terçado* (large wooden knife) and *machado* (axe) had already succeeded the Stone Age. I do not know whether pottery ever has played an important part in the lives of these Indians, as it has with many of the tribes living on the larger rivers, where clay is abundant. The vessel of indigenous manufacture most largely in use at present is the *cúya*, made in all sizes and sorts—large ones from the shell of the *cuiero* fruit, small ones from several sorts of gourds. Baskets and mats also are remains of indigenous handicraft, and many of the hammocks are even today of the old Indian make, knitted from palm-fibers.

The Tembé language is still spoken by most of the adult Indians and by some of the younger generation, too, but it is disappearing. It is a dialect of the widely spread Tupy-Guarany, from which the *língua geral* is derived. Though it is but natural that the ethnographer's attention today is chiefly concentrated on the fast-vanishing tribes in a completely wild state, it seems a pity that these semi-civilized tribes are not more intimately studied.

Only the naturalist who has lived for years in the country and come into intimate contact with all classes and races and knows the conditions of life in Brazil can appreciate the multitude and the importance of the cultural and racial problems that still require solution. The curious blending of three races has left deep traces, not only on the outward appearance of the people, but also on their costumes, plays, and folk-lore. I spent part of June, 1915, in Prata. Every Sunday and holiday, at night, a peculiar musical noise (it hardly could be termed music in our sense of the word), drumming and trumpeting on strange instruments, interrupted by monotonous chanting, was heard, and a curious procession of men and boys clad in fantastic costumes with hats of flowers or crowns of feathers, some of them painted black or red, marched around, leading about a rather coarse imitation of an ox and from time to time performing a sort of pantomime that invariably ended with the killing of the ox (*matando o boi*). That was the famous *boi-bumba*, the popular summer entertainment of the Amazonians. Even in the capital, the *boi-bumba* is a favorite spectacle with the lower classes, and its noise is often enough heard from afar in

the main streets and open places of the suburbs. But as it is rather looked down upon and proclaimed as shocking by the educated people, it really has somewhat degenerated, and the opportunity to study it is not very favorable. In the country, however, it still has the character of a legitimate popular festival, most interesting from the point of view just mentioned, as showing elements evidently belonging to all three Brazilian races. I shall not attempt here to give a thorough history or explanation of the play, which indeed has never been tried, so far as I am aware. However, relics of Indian and negro superstitions are distinctly traceable in it, and the whole has been modified, as is so often the case, by the highest of the three races. This may be inferred from the time at which the pantomime is performed, being St. John's day in Amazonia, and the Epiphany in the south of Brazil.

EUROPEAN WAR MAPS

The maps to be used in studying the military campaigns of the present war in Europe may broadly be divided into two classes, detailed topographical maps, and general maps. The former embody the large-scale official surveys of the various belligerent countries, while in the second class may be grouped the smaller-scale maps, many of them approximating the standard scale of 1:1,000,000, or about 16 miles to the inch, which give a general view of larger areas.

The topographical sheets are the fundamental maps; on these, directly or indirectly, all other maps are based. Except for parts of the Balkan Peninsula, all the countries of Europe have been covered by government surveys, carried out, as a general rule, by the respective war offices. In scale they vary from 1:25,000 (about 2,000 feet to the inch) to 1:200,000 (over 3 miles to the inch), with a tendency to average about 1:100,000, or 1½ miles to the inch. All of these maps existed before the war; and, for the student of the military operations of the conflict, it is simply a question of selecting those best suited to his purpose. Such a selection is attempted in the list below (see Nos. 7-10, 15, 20, 23, 24); comprehensive descriptions are available elsewhere.¹ As a rule the typical, rather than the largest-scale series have been enumerated, although the latter, such as the 1:20,000 map of Belgium, should be consulted in an intensive study of individual problems. Preference has also been given to colored maps; the 1:80,000 black-and-white map of France, although the standard, has been omitted because of its illegibility.

Some maps, although they are compilations and not directly based on surveys, may, on account of their relatively large scale, be classed with the topographical maps. To these belong the 1:250,000 map of the Balkans by the British War Office (No. 25) and the admirable map of Italy on the same scale by the Italian Touring Club (No. 21).

The general maps include both official maps and maps published by private firms. Some of the most valuable maps, geographically, of the regions concerned are to be found among the official maps of this class; although they are mostly on a larger scale than in the atlases in common use, they are synoptical and generalized in character (see Nos. 1, 2, 3, 26). Most of the war maps issued by private firms are adaptations of existing

¹ Vinzenz Haardt von Hartenthurn: *Die militärisch wichtigsten Kartenwerke der europäischen Staaten*, *Mitt. des k. und k. Militärgeogr. Inst.*, Vol. 27, 1907, pp. 96-239, Vienna, 1908.

W. Stavenhagen: *Skizze der Entwicklung und des Standes des Kartenwesens des ausserdeutschen Europa*, *Ergänzungsheft No. 148 zu Petermanns Mitt.*, 376 pp., Justus Perthes, Gotha, 1904.

G. M. Wheeler: *Report upon the Third International Geographical Congress and Exhibition at Venice, Italy, 1881*, Accompanied by *Data Concerning the Principal Government Land and Marine Surveys of the World*. 568 pp. Corps of Engineers, U. S. Army, War Department, Washington, 1885.

plates or combinations of maps contained in atlases previously brought out by the publishers. If taken from a good atlas, such maps often are excellent (see Nos. 16 and 17, the former not printed specifically as a war map). Few of the commercial war maps are original or contain information distinctively bearing on the war, other than overprints in red showing the location of fortresses, etc. One group that forms an important exception should be noted: the maps that indicate the position of the battle lines at different dates (Nos. 6, 12, 14, 19). Another group that is especially valuable consists of the physical maps, which show relief by means of altitude tints (Nos. 5, 13, 22).

Most of the maps that portray actual war conditions will probably not be made public until after the cessation of hostilities. To this category belong the detailed maps showing the location of trenches and other military works which are constantly being prepared at the front from photographic reconnaissances by airplane. A few maps of this type have, however, been published, some accompanying magazine articles; and the land operations of the Gallipoli campaign are cartographically laid down on a map published by the British War Office (No. 28).

In the following list, arranged according to battle fronts, a brief characterization is added in brackets after the title of each map.

EUROPE AS A WHOLE

(1) **Europe and Asia.** 1:1,000,000. Compiled at the Royal Geographical Society under the direction of the Geographical Section, General Staff. Drawn and printed by the Ordnance Survey, Southampton, 1914 to date. At least 39 sheets issued. [Each sheet 4° in lat. and 6° in long. (12°, north of 60° N.). Drainage in blue, relief in brown contours (interval 200 meters in Europe, 500 in Asia), roads in red, railroads in black.]

(2) **Europe.** 1:1,000,000. Service Géographique de l'Armée, Paris. At least 15 sheets issued. [Each sheet 4° in lat. and 6° in long. Drainage in blue, relief in brown shading, roads in red, railroads in black.]

(3) **Übersichtskarte von Europa.** 1:750,000. Militärgeographisches Institut, Vienna. 40 sheets. [Each sheet 3° in lat. and 4° in long. Drainage in blue, relief in brown shading (another edition with contours and altitude tints), roads in red, railroads in black, woods in green.]

(4) **Generalkarte von Mitteleuropa.** 1:200,000. Militärgeographisches Institut, Vienna. 282 sheets. [Covers Austria-Hungary and adjacent regions. Each sheet 1° in lat. and long. Drainage in blue, relief in brown hachuring, railroads and roads in black, woods in green.]

(5) **Bartholomew's Orographical Map of Central Europe.** 1:2,000,000. John Bartholomew and Co., Edinburgh. [Excellent map with altitude tints.]

(6) **Kriegsstands-Karte der Deutschen und Österreichisch-Ungarischen Armeen in 14tägigen Kurven.** 1:4,000,000. Dietrich Reimer, Berlin. [Shows together, on one map, the progressive positions of the eastern and western fronts at intervals of two weeks. The present edition covers the period from the beginning of the war to November 1, 1914.]

WESTERN FRONT

(7) **Carte topographique de la Belgique.** 1:100,000. Institut Cartographique Militaire, Brussels, 1903-12. 26 sheets. [Drainage in blue, relief in brown contours (interval, 10 meters), roads in red, railroads in black, woods in green.]

(8) **Carte de la France dressée par ordre du Ministre de l'Intérieur.** 1:100,000. Librairie Hachette et Cie., Paris. 587 sheets. [Drainage in blue, relief in gray shading, roads in red, railroads in black, woods in green.]

(9) **Carte de France.** 1:200,000. Service Géographique de l'Armée, Paris. 82 sheets. [Drainage in blue, relief in brown contours (interval, 20 and 40 meters), roads and railroads in black, woods in green.]

(10) **Carte de France dressée au Dépôt des Fortifications.** 1:500,000. Service Géographique de l'Armée, Paris. 15 sheets. [Drainage in blue, relief in brown contours (interval, 100 meters), roads and railroads in black, woods in green.]

(11) **Carte du Théâtre des Opérations (Front Occidental).** 1:500,000. Service Géographique de l'Armée, Paris. 15 sheets. [A special reprint, divided into quarter sheets, of the northeastern part of the map by the Dépôt des Fortifications, listed immediately above.]

(12) **Nord-Est de la France, Alsace, et Belgique.** 1:500,000. Imprimerie Berger-Levrault, Nancy. [Bears somewhat faint but detailed purple lines showing the front on April 1, 1916, and the maximum advance of the Germans in September, 1914.]

(13) **Bartholomew's [Physical] Map of North-Eastern France, Belgium, and the Rhine.** 1:1,000,000. John Bartholomew and Co., Edinburgh. [Excellent map with altitude tints.]

(14) **Stanford's Half-Inch Map:** (a) of the British Front in France and Flanders, 1:126,720; (b) of the Battle Front between the Somme and Soissons, 1:126,720. (Stanford's War Maps, Nos. 17 and 18.) Edward Stanford, London. [A bold but detailed red line shows the position of the battle front on June 27, 1916. Possibly other maps, not received by the Society, complete this series.]

EASTERN FRONT

(15) **Special Map of European Russia.** 1:420,000. Military Topographical Section of the General Staff, Petrograd. 177 sheets. [In Russian. Drainage in blue, relief in brown hachuring, roads and railroads in black, woods in green.]

(16) **Map of European Russia, begun by E. Petri and completed by J. M. Schokalsky.** 1:2,000,000. Pls. 15-30 of Mareks's Atlas. A. F. Mareks, Petrograd. [In Russian. The best general map of Russia available. Relief in brown hachuring. The atlas of which these sheets form a part is a Russian edition, engraved in Germany, of Debes' Handatlas, Leipzig. These sheets of Russia, however, are engraved in Petrograd.]

(17) **Deutsch-Russische Grenzlande.** 1:2,000,000. Velhagen und Klasing, Leipzig. [Possibly the best general locational map of the eastern war zone. Reprinted and combined from sheets in Andree's Handatlas.]

(18) **Carte du Théâtre des Opérations (Front Oriental).** 1:1,000,000. Service Géographique de l'Armée, Paris. 20 sheets. [A special reprint, differently subdivided, of the French map of Europe, 1:1,000,000, listed above under (2).]

(19) **The Russian Battle Front in Europe.** 1:217,600. (Stanford's War Maps No. 19.) Edward Stanford, London. [Shows, in red, the position of the battle fronts in April, 1915, and in September, 1915, or before and after the great German advance.]

AUSTRO-ITALIAN FRONT

(20) **Carta Topografica del Regno d'Italia.** 1:100,000. Istituto Geografico Militare, Florence. 277 sheets. [Various types; the most feasible the *edizione policroma con l'orografia a curve e sfumo*—with relief in contours (interval, 50 meters) and shading.]

(21) **Carta d'Italia del Touring Club Italiano.** 1:250,000. Prepared by the Istituto Geografico De Agostini, Novara, for the Touring Club Italiano, Milan. 58 sheets. [A superb map, representing the acme of the engraver's art. Relief in masterly hachuring in brown, supplemented by unobtrusive contours.]

(22) **Carta Ipsometrica: Le Tre Venezie (Venezia Tridentina, Venezia Propria, Venezia Giulia).** 1:250,000. Istituto Geografico De Agostini, Novara. [An edition, with altitude tints, of the corresponding part of the Italian Touring Club map listed immediately above.]

BALKAN FRONT

(23) **Topographical Map of Serbia.** 1:75,000. Geographical Section of the General Staff, Belgrade. 97 sheets. [In Serbian. Relief in brown contours (interval, 50 meters), roads in red, woods in green.]

(24) **Topographical Map of Rumania.** 1:50,000. Geographical Institute of the Army, Bukharest. 415 sheets. [In Rumanian. Drainage in blue, relief in contours (interval, 10 meters), woods in green.]

(25) **The Balkans.** 1:250,000. Geographical Section, General Staff, War Office, London. 11 sheets. [An eastward extension of a map known as "Turkey in Europe, Eastern and Central," published in 1910, which in 10 sheets covers the remainder of Turkey in Europe, as formerly constituted. Drainage in blue, relief in brown contours, woods in green.]

(26) **Balkans.** 1:1,000,000. Service Géographique de l'Armée, Paris. 6 sheets. [Identical in execution with the French map of Europe, 1:1,000,000, listed above (No. 2).]

(27) **Map of the Peninsula of Gallipoli and the Asiatic Shore of the Dardanelles.** 1:63,360. Geographical Section, General Staff, War Office, London, 1915. [A large-scale map. Relief in contours, interval 100 feet.]

(28) **Map of the Anzac Position, Gallipoli, to illustrate Sir Ian Hamilton's despatch of December 11th, 1915.** 1:20,000. Geographical Section, General Staff, War Office, London, 1916. [A detailed map showing the position of the British and Turkish trenches as known on August 6, 1915. Relief in brown contours, interval 10 feet.]

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Award of the Charles P. Daly Medal. The Charles P. Daly Medal for Geographical Research has been awarded to Professor George G. Chisholm of the University of Edinburgh, Scotland. The inscription on the medal explains the selection of Professor Chisholm for one of the highest awards of this Society in 1917. It reads as follows:

TO
GEORGE GOUDIE CHISHOLM
SCHOLAR, TEACHER, AUTHOR
THROUGH SUSTAINED RESEARCH
AND BROAD GENERALIZATION
HE HAS CREATED A WORLD-WIDE
INTEREST IN THE GEOGRAPHICAL
BASIS OF COMMERCE

Professor Chisholm was one of the first to develop a body of scientific principles in the field of commercial geography and to organize a great mass of economic data. He has presented his material with rare breadth and clearness in a number of standard and widely known publications.

Award of the David Livingstone Centenary Medal. The David Livingstone Centenary Medal has been awarded twice since its foundation in 1913, first to Sir Douglas Mawson and second to Colonel Theodore Roosevelt. A third award has now been made, to Manuel Vicente Ballivian, president of the Geographical Society of La Paz, Bolivia. Señor Ballivian has done more for the promotion of geographical knowledge in Bolivia than any other man in the history of that country. This achievement he has accomplished no less by the encouragement of young men, and especially explorers, than by the broad scholarship displayed in his own researches and by his indefatigable efforts to secure government aid for geographical and statistical work.

NORTH AMERICA

Domesticated Reindeer in Alaska and the Canadian North. Into the eastern and western extremities of North America the domesticated reindeer has been successfully introduced from the proximate ends of the Old World. To Alaska reindeer from the Tungus were first brought in 1892. How well they have thriven and how materially they are helping to raise the status of Innuít and Indian is clearly demonstrated in the reports of the U. S. Bureau of Education, under whose jurisdiction they fall. The current report, that for 1914-15 (*Bur. of Educ. Bull.*, 1916, No. 47, Washington, 1917), indicates a continuance of the uninterrupted success that has attended the service since its inception twenty-five years ago. Although nearly 9,000 head of reindeer were slaughtered during the year, the net increase was 21 per cent, and the total herd now numbers over 70,000. Plans are under way for the commercialization of the industry. The trial shipment of meat to Seattle noted in the last report (see the *Geogr. Rev.*, Vol. 1, 1916, p. 228) has been repeated, and a proposal from a cold-storage company to market the meat on a commission basis has been laid before the native owners.

Dr. Grenfell's introduction of reindeer from Lapland into northern Newfoundland made several years later (1908) has likewise proved successful and has benefited greatly the fisherfolk of that inhospitable shore. But a later attempt on the part of the Canadian government met with disaster. In 1911 fifty head of reindeer were purchased from Dr. Grenfell for introduction into the Northwest Territories. The story of this unfortunate experiment is recounted by Emile Miller in a recent article (*L'Introduction du renne en Amérique*, *Bull. Soc. de Géogr. de Québec*, Vol. 11, 1917, No. 1).

The herd was shipped via Sydney, Cape Breton, to Athabaska Landing, whence it wintered at Fort Chipewyan. At the beginning of the succeeding summer, diminished by nineteen, it was taken to an enclosure in the vicinity of Fort Smith. But the plague of gad-flies so tormented the unhappy beasts that they promptly broke their bounds. Only a dozen were recaptured and one of these died shortly. During the winter the eleven survivors were stabled and fed upon lichens and hay. The diet proved fatal to

seven. The remaining four were then moved to an island in Great Bear Lake, where two more succumbed, and the experiment appears to have terminated.

But the impracticability of the acclimation of the reindeer in northern Canada as a whole is not proved thereby. The experiment failed through ignorance or disregard of the character of the natural habitat of the beast. The reindeer can hardly be expected to thrive in a region where the summers are warm enough for wheat cultivation. It is true that in the winter the caribou migrates far south, as the name Reindeer Lake testifies, but in summer return is made to the north. The southern summer limit of the caribou runs approximately from Chesterfield Inlet on Hudson Bay to the northern shore of Great Bear Lake; in the western part it is roughly coincident with the northern limit of trees. The neighborhood of the former point should prove a veritable reindeer paradise. But against introduction here it is urged that only the Yellow-Knives and Dog-Ribs would be benefited. Apart from the ethical argument still favorable to the project, the outposts of civilization would at least gain indirectly. The settlers in the Mackenzie Basin should then find the Indians of the Barren Grounds more desirable neighbors, and by gradual extension of the reindeer westward a practicable route from Great Slave Lake to Hudson Bay could be established.

The Basis for the Official Designation of Lassen Peak. In the February *Review* (p. 148) under the well-chosen heading "The Local Name of Lassen Peak" is given an account of local usage that deserves more than ordinary attention. Local usage is sometimes ephemeral, but in cases involving literature names should not be changed without good reason. The recent volcanic activity of Lassen Peak has given it not only national but international prominence as one in the belt of active volcanoes girding the Pacific. There should be no confusion concerning its name. It may therefore not be amiss to outline somewhat fully the evidence that impelled the U. S. Geographic Board to render its decision in favor of the form "Lassen Peak," as enlarged upon in the *U. S. Geological Survey Bulletin No. 294* (see the December, 1916, *Review*, p. 464).

The rush of gold seekers overland to California in 1848 to 1853 and the Government survey for a railroad route to the Pacific about the same time drew marked attention to all guiding peaks and mountain passes by the way. One of the routes surveyed by Capt. E. G. Beckwith in 1854 traversed Noble's Pass from Susan River to the Sacramento Valley, touching the northern base of Lassen Peak, and in his hachure map of this portion of his route (*Pacific Railroad Survey Repts.*, Vol. 11) Beckwith gives a clear view of Mount St. Joseph, with its radial drainage of Hat Creek, Battle Creek, and the head of Feather River well defined and named. In the text (*ibid.*, Vol. 2) Beckwith mentions Mount St. Joseph a number of times and adds, parenthetically, "sometimes called Lassen's Peak." Note the possessive form and the correct spelling. Beckwith followed the old immigrant road then in use and touched the base of "Black Butte," now well known as the Cinder Cone, of which he gives a brief account. On Beckwith's map Lost Creek is called Wolf Creek, which joins Hat Creek to form what was then called Canoe Creek, the scene of the almost disastrous floods following the great eruptions of Lassen Peak on the night of May 19 and the afternoon of May 22, 1915.

Peter Lassen, the Danish trapper, at the time the railroad route surveys were made, was the most active guide and noted pioneer of the region, and Lassen Peak was well named in his honor. To this all agree, and it is equally apparent that the form Lassen's Peak was the first and only local usage of early mining days. To trace local usage from then till now we must be guided largely by definite records in maps and reports concerning the region.

Among the maps of northern California in the Library of Congress and other large libraries in Washington, D. C., there are at least thirty giving sufficient detail to locate and name the mountain under consideration. On these maps five names are used for the mountain. One map calls it Mount St. Joseph, as already noted; another calls it Lassen Mountain; five call it Mount Lassen; eight Lassen Butte, and fifteen Lassen Peak.

As to Lassen Butte or Lassen Peak, Whitney's statement given below should be decisive in favor of Lassen Peak.

J. D. Whitney, W. H. Brewer, and Clarence King of the California Geological Survey visited the mountain in 1863 and were the first to study and describe its remarkable features. Incidentally in a footnote (*California Geological Survey: Geology*, Vol. I, 1865, p. 310) Whitney refers to the name of the mountain and remarks: "This is the volcanic mass designated as Mount St. Joseph on the Pacific Railroad maps; but it is universally known in California as Lassen's Butte or Peak; we prefer the English word, especially as the French one is not properly used when applied to a high mountain. A butte, according to the dictionary of the French Academy, is a '*petite élévation de terre*' or a '*petit tertre*'; 'knoll' would be the exact translation."

The local usage of the name Lassen Butte or Lassen Peak that prevailed in Whitney's day appears to have prevailed in a greater or less degree up to the present time. No other names for the mountain appear upon the maps examined that were published before 1884, and this includes not only those of private compilation but also the Government publications, the especially valuable map of the California Geological Survey in 1874, the General Land Office map in 1876, and the Wheeler Survey map in 1879, which is the result of a large amount of field work upon and about Lassen Peak that familiarized the topographer in charge not only with topographic details but also with the local usage of names.

George Sandow made the subdivision survey of Township 30 North, Range 4 East, at intervals from 1871 to 1883, and his township plat was accepted by the General Land Office on March 28, 1884. Lassen Peak stands just outside of the township line on the north side but was included by Sandow in his plat under the name Mount Lassen. This is, as far as I am aware, the first appearance of the name Mount Lassen in public records. The plat shows the rim of an old crater extending as a prominent ridge about three miles to the southwest from Mount Lassen, to what Sandow has called "South Butte of Mt. Lassen." This latter prominence is now known, especially to the Forest Service, as Brokeoff Mountain and is in plain view from the Sacramento Valley.

Apparently as a direct result of Sandow's use of the name Mount Lassen, Keddie of Plumas County, who had previously called the mountain Lassen Butte (1886), changed it to Mount Lassen (1892) on the official map of Plumas County. It should be remembered, however, that the mountain is not in Plumas County, but in Shasta County, to be noted later.

The General Land Office maps of 1885 and 1891 used the name Mount Lassen, but in 1900 and 1913 they apparently returned to Lassen Peak for the mountain within the Lassen Peak National Monument. On the map for 1913, however, a new element of confusion was introduced in applying the name Mount Lassen to what has been already noted as Brokeoff Mountain.

Lassen Peak is in Shasta County, and, on the three maps of that county examined, two contained the name Lassen Butte and the third Lassen Peak. There is but one more state map to which attention need be called, namely, the "Geomorphic Map of California and Nevada," 1908. It was prepared with great care by the Earthquake Investigation Commission, and the names it contains, among which is Lassen Peak, are based on well-considered authority.

The matter of local usage is undoubtedly of great importance in considering the adoption of names. For this reason I may be permitted to refer very briefly to my own experience on many trips into that region during the last thirty-three years. My first ascent of the peak was in July, 1883, and the greater portion of the summers from 1885 to 1893 was spent in that region surveying for the Lassen Peak geological folio. To study the recent volcanic activity of the mountain I made numerous ascents of the peak in the summers of 1914, 1915, and 1916. During the whole of this long experience (1883 to 1916), with abundant opportunities to learn the opinions of the people, local usage as to the name of the peak was carefully noted. A considerable number have called it Lassen Butte, and the name is still used locally in Shasta County, but much the more common local usage throughout the region during 1882-84, when the topographic and geologic surveys were made for the folio, was Lassen Peak. The name Mount Lassen was rarely used in that region as early as 1885.

The publication of the Lassen Peak folio and other reports, including Whitney's of the California Geological Survey on the geology of the region, gave to the name Lassen Peak a definition that fixed it to the mountain more securely than any other name. Its use in designating the Lassen Peak National Monument and the first National Forest of the region gives it a legal status, and when the U. S. Geographic Board was asked for the correct name of the mountain, with the evidence already cited as to the use of the name, it readily decided in favor of Lassen Peak.

There can be no doubt, however, that within the last few years since the recent volcanic activity appeared the local use of the name Mount Lassen has greatly increased, but the name Lassen Peak is still in local use, and prevailing in general use. Professor R. S. Holway of the University of California and other writers who use names with care, so as to avoid confusion when writings are compared, use Lassen Peak.

The widespread use of the name Mount Lassen is to be found in the newspapers. The volcanic activity of the mountain is reported to the Associated Press and spread all over the country by the *Searchlight* of Redding, an excellent daily that is keenly alive to the best interests of the country. A few months ago a lecturer in Redding concerning the volcanic eruption called the mountain Lassen Peak. He was reminded of local usage, and to correct what is considered a wrong tendency in the press the U. S. Geological Survey issued *Press Bulletin No. 294*. It is gratifying to note that

the *Searchlight*, with commendable zeal, now sends out the Associated Press dispatches sometimes, if not always, with the name Lassen Peak, and if other papers would do likewise local usage would soon correct itself and by adopting the name Lassen Peak prevent avoidable confusion among scientific writers.

In closing I wish to emphasize the fact that the name Mount Lassen lacks priority and the authority of general publication. Furthermore, its use has been rendered confusing by being applied, as already pointed out, not only to Lassen Peak but also to Brokeoff Mountain. It is earnestly hoped that the press may exercise its righteous function of safeguarding science by changing local usage from Mount Lassen to Lassen Peak. J. S. DILLER.

Saskatchewan's "Bumper" Wheat Crop of 1915. To the world's record wheat crop of 1915 Canada's prairie provinces contributed a full quota (C. C. James: *An Historical War Crop—The Canadian Wheat Crop of 1915*, *Trans. Royal Soc. Canada*, Ser. 3, Vol. 10, 1916; for wheat area see map on p. 28 in this number). Saskatchewan, premier of the three provinces in wheat production, alone raised 173,723,775 tons. This record, in part accounted for by increased acreage, is due still more to increased yield following unusually favorable climatic conditions. The favoring circumstances for the 1915 crop began in the previous year. The lightness of the 1914 crop reduced soil depletion and permitted more summer fallowing and fall ploughing, while the latter operation was also encouraged by a protracted period of fine weather. The year 1915 opened auspiciously. The mildest February on record for twenty years was followed by an early spring. Seeding was carried out in fine April weather. In response to the war call for expansion of food resources the area planted was extended to approximately 6,885,000 acres, representing the culmination of a steady progress from the million or so acres under wheat when Saskatchewan was created a province in 1905. Plentiful rains fell in June and early July. For the greater part of the province harvesting and threshing were carried out under "ideal weather conditions," though the heaviness of the crop protracted operations into November in the southwestern region. Yield and quality alike proved high. Against an average yield of 19.5 bushels per acre and a minimum of 12.4 in 1914 the crop of 1915 yielded 25.2, a figure only slightly exceeded in the province by the record of 1901 (*Ninth Ann. Rept. Secretary of Statistics, Dept. of Agric., Prov. of Saskatchewan*, Regina, 1916).

The Glaciers of the Torngat Mountains, Labrador. The highest and also the least-known mountains in eastern Canada are the Torngats (or Torngaks) in the Ungava Peninsula of northeastern Labrador. They have been supposed to reach an altitude of 10,000 feet and to have the distinction of being the highest mountains in North America east of the Rockies. They would have a double distinction if they should be found also to support living glaciers, for the glaciers of other mountains farther south vanished in the remote past. But their height above sea level is probably not more than 6,000 feet, according to the recent studies of Dr. A. P. Coleman, who visited them in 1915 and climbed Mt. Tetragona ("Mt. Tetragona: A First Ascent in Labrador," and "The Building of the Torngats," *Canadian Alpine Journ.*, Vol. 7, 1916, pp. 5-11 and 67-70). Dr. Coleman did find many small living glaciers, but, if correct, his estimate of the height of the highest summit—about 6,000 feet—leaves Mount Washington in New Hampshire (6,290 feet) the highest peak east of the Rockies.

The Torngats are wholly without timber. They break down so abruptly to sea level on the east (probably a fault-line scarp), and their relief is so rugged, that they have an extraordinarily bold and impressive seaward aspect, in spite of the presence of considerable remnants of a former domed surface that has survived erosion on the landward side. This domed surface was a preglacial plateau—once part of the extensive and well-known Laurentian peneplane—now greatly dissected by local glaciers which have diminished in length until at the present time they occupy, with their tributary snow-fields, very limited areas at the bases of the cirque walls. The glaciers are still at work in the higher cirques and valleys, but none seems to be very active. Formerly they were large and powerful and cut great valleys with sharp-crested ridges and bold isolated mountains between. In some places the main lines of ice drainage afforded outlets to the sea for the great Labrador ice sheet of the past, just as the marginal tongues of the inland ice of Greenland flow to the sea in troughs cut across the rugged coastal belt.

SOUTH AMERICA

A Campaign Against Malaria in Peru. The Peruvian Government is instituting a campaign against malaria, a disease that, under the unsanitary conditions generally existent in Peru, forms a serious obstacle to progress in some of the most promising sections of the country (*South American Journ.*, April 7, 1917, p. 301). Certain parts

of the coast valleys are prone to malaria in the latter part of the summer season, when subsiding floods and maximum temperatures supply optimum conditions for the disease carriers. In the past Lima and all the lower Rimac valley have been notorious for their intermittent fevers. This insalubrious spot was one of the localities to which criminals were despatched in Inca days. Though conditions in the city have improved of late the outskirts still possess a bad reputation (Ignacio La Puente: *Paludismo en la costa del Perú*, *Bol. Soc. Geogr. de Lima*, Vol. 31, 1915). Still more serious is the disease in the deep-cut valleys that penetrate the heart of the plateau. There malarial conditions flourish the year round, merely augmenting somewhat at the beginning and end of the rainy season. The phenomena in the Marañon valley have been described by Raimondi ("El Departamento de Ancachs," Lima, 1873).

In prosecution of the campaign the Peruvian Government proposes to import, duty free, the necessary quantity of quinine. The statement is an interesting reminder both of the lack of industrial development in Peru and of the still unutilized resources that wait more favorable conditions for exploitation. The *montaña*, the lower slopes of the Eastern Andes from Ecuador to Bolivia, is the native home of the cinchona species. Once Peru and Bolivia exported large quantities of the "Peruvian bark," though the drug was never fabricated. Of recent years even export of the crude article has practically ceased: it cannot compete with the better circumstanced product of the East.

The Age of the Bolivian Andes. In a paper of only three pages (E. W. Berry: *The Age of the Bolivian Andes*, *Proc. Natl. Acad. of Sci.*, Vol. 3, pp. 283-285, April, 1917) there are announced some remarkable fossil evidences which confirm recent physiographic conclusions as to the late Tertiary and early Pleistocene uplift of the Central Andes. Fossil plants at Corocoro (13,000 feet) and Potosí (14,000 feet), which include a fern and tropical trees allied to those now living on the Amazon lowlands, denote a more humid climate and a far lower elevation, and, the author says, "the sea deposited a part of these strata [on the Bolivian highland] in late Tertiary or Pleistocene time, and since that time there have been differential vertical movements amounting to a minimum of 13,500 feet." The author concludes: "There is, then, definite evidence that parts of the high plateau and of the eastern Cordillera stood at sea level in the late Tertiary."

In various papers in past years Bowman has demonstrated the rapid and recent uplift of the Central Andes and more recently in "The Andes of Southern Peru" (1916) has elaborated a physiographic argument, based on detailed topographic surveys in southern Peru, which concludes that an uplift of at least 7,000 feet is demonstrable and that it may have been much more. The convergence of the physiographic and the fossil evidence is singularly conclusive, and the full report on the fossil evidence may be expected to form one of the major contributions to the physiographic history of the Andes within the decade.

Changes in the Character of the Precipitation in British Guiana. A recent critical examination of past meteorological records relating to Georgetown, Demarara, has led to some interesting results, especially with regard to rainfall. The observations under consideration included an earlier series for the period 1846-56, taken in the Observatory, and a later series for 1882-1915, taken at the Botanic Gardens. The later series was divided into three sub-groups, and the average annual rainfall characteristics of the four periods thus obtained were worked out in detail. While the average annual rainfall for the four periods shows the fluctuation to be anticipated, the character of individual rainfalls is marked by a steady progressive change in the direction of greater frequency and diminished intensity. This appears in the following table.

PERIOD	DAYS OF RAIN				RAINFALL IN INCHES
	< ½ in.	½-2 ins.	> 2 ins.	Total	
1846-1856.....	114	54	9	177	95.86
1882-1896.....	126	53	8	187	93.57
1897-1906.....	150	50	6	206	89.86
1907-1915.....	164	48	6	218	99.92

These figures are given in the 1915 report on British Guiana by the British Colonial Office (*Ann. Colonial Repts. No. 910*, London, 1916). The examination of the meteorological records referred to above was incident on a change in the form of the annual publications. Whereas the detailed report formerly appeared in the Blue Book for the colony, it will now be incorporated in the Annual Report of the Meteorological Division of the Department of Science and Agriculture and the record in the Blue Book will be confined to a fairly full summary.

A New Publication of the Argentine Meteorological Office. With the month of January, 1916, the Argentine Meteorological Office began the issue of a monthly bulletin. This is a quarto publication, and the first number contains 40 pages, with six maps and one diagram. The plan of the *Boletín Mensual* is to supplement the regular data given on the daily weather map by means of more complete and more accurate information than is obtainable by telegraph. The tables are unusually complete and give the monthly summaries for 75 stations, thrice-daily observations for 23 selected stations, and rainfall data for 1,421 stations. A series of excellent charts show the total rainfall for the month, the excess and deficiency of the monthly rainfall in relation to the normal, the total rainfall from July 1 to January 31, the excess and deficiency of the rainfall from July 1 to January 31 in relation to the normal for that period, the mean temperature, pressure, and the prevailing winds for the month, and the absolute maximum and minimum temperatures for the month. The new *Boletín Mensual* maintains the high standard of all the publications of the Argentine Meteorological Service. The February, 1916, number of the *Boletín* contains, in addition to the matter above noted, a summary of the weather of the month by Mr. H. H. Clayton, the Chief of the Forecasting Division.

R. DEC. WARD.

EUROPE

Soundings as an Aid to Navigation in Approaching the French Coast. A recent communication dealing with methods of recognizing an unlighted coast from a ship nearing land in foggy weather is of particular interest in these war days (J. Renaud: *Les atterrages, en temps de brume, des grands ports français sur l'océan Atlantique, Comptes Rendus de l'Acad. des Sci. de Paris*, June 11, 1917). In favorable weather the outline of the coast enables the mariner to determine the location of the port for which he is bound. Whenever the visibility is low, however, an easy way of ascertaining the ship's position, once land is sighted, is to take soundings and bottom samples and thus to identify one's position on the chart. The example is given of a vessel bound for Havre from a port in North America and traveling continuously under a clouded sky which prevents the officers from taking astronomical observations. At the entrance to the Channel soundings will enable the captain to determine his position. The depth decreases here in a fairly uniform manner. Nearing the French coast the vessel would keep its course in waters exceeding 16 fathoms (30 meters) in depth, thus rounding the Pointe de Barfleur and entering the estuary of the Seine, where the depths begin to decrease. By hugging the southern shore of the estuary it is possible to reach the Havre anchorage with the sole aid of bathymetric data.

Near Brest the bottom is rough and dangerous. While the making of this port shortens transatlantic trips by five to seven hours, the time saved can hardly be reckoned as a compensation for the numerous shoals and rocks which beset the approaches. In war times, of course, these obstacles are favorable to the defence. Farther south, between Penmarch and the mouth of the Gironde, there is very little difficulty in estimating the ship's position by means of soundings. The bottom of the sea here slopes uniformly towards the region where oceanic depths begin. A wide deposit of ooze helps furthermore in detecting this locality. By exercising ordinary caution a ship can proceed landward from a depth of 164 fathoms (300 meters) until the 27-fathom (50 meter) line is reached. Beyond that, soundings alone do not suffice, as is the case at the mouth of the Seine. Only La Pallice, the harbor of La Rochelle, can be made by soundings, by proceeding along the south wall of the Antioche deep.

In war times, when lights are frequently extinguished along the coast, these undersea determinations are of the utmost importance and testify to the great value of detailed oceanographic investigation.

The Distribution of Italy's Power Resources. Italy's position in the war is greatly affected by her scarcity of fuel. The Italians, taken as a whole, are farmers rather than manufacturers. At the same time the high development which technical science has attained in Italy tends to force the country into the ranks of industrial producers. In taking stock of their power resources, Italians found that their northern provinces contained lignite beds which were susceptible of development. From 600,000 tons produced in 1913 the output was increased to 1,200,000 in 1916. According to information from F. T. F. Dumont, American Consul at Florence (*Commerce Repts.*, May 24, 1917), this quantity is estimated to be the maximum which can be obtained from the Italian beds. Other sources of energy will have to be utilized; and attention is being turned to forestry and water power.

Italy's forests cover a scant 13 per cent of the peninsular area. Deforestation has been excessive, particularly in the south. The power to be developed from this source

is negligible. As an offset to this disadvantage the streams of northern Italy, especially in the Provinces of Piedmont, Lombardy, Venice, Tuscany, and the Abruzzi, contain potential energy which has been estimated at 5,000,000 horse-power. Less than one-fifth of this amount is now available. The development of this energy would free Italy from dependence on foreign coal.

The situation as regards power in Italy is therefore related to developments in the northern districts. In the hydro-electric field the mechanical energy to be obtained is transmissible as far south as required.

Hydro-electric Power in Russia. An official estimate places the potential value of Russian water power at not less than 12,000,000 horse-power, of which today only 10,000 horse-power is being utilized. The calculated resources lie chiefly in the mountainous regions of Asiatic Russia, far from centers of industry, but there also exists a considerable resource in the glaciated lake area adjoining Finland on the east that could be put to immediate use. The lately completed railroad line from Petrograd to Kola and Catharine Harbor (see "Russia's Wartime Outlets to the Sea" in the *Geogr. Rev.*, Vol. 1, 1917, pp. 128-132; also *Commerce Repts.*, 1917, No. 28) might be electrified, at least in the section across the Kola Peninsula. While the line is today of predominantly military importance it has prospects for an economic future. Some day the thousands of square miles of virgin forest covering the region traversed by the railroad will be exploited and its water powers will undoubtedly be in demand (Charles Rabot: *La Houille Blanche en Russie*, *La Nature*, March 31, 1917).

AFRICA

Economic Exploration in French West Africa. M. René Chudeau, who in 1913-14 carried out an extensive exploration on the eastern margin of the Djouf, one of the sand areas of the Sahara, is reported to have returned from another Saharan journey (*Bull. Soc. de Géogr. de Paris*, Vol. 38, 1916, No. 7-9, pp. 454-455; on the 1913-14 journey, see "L'Azaouad et le Djouf," *La Géogr.*, Vol. 30, 1914-15, pp. 417-436, with map, 1:200,000, and other articles cited therein). This last journey, accomplished under the auspices of the Colonial Office and the Geographical Society of Paris, was designed to investigate the economic possibilities of that portion of Upper Senegal traversed by the railroad from Kayes to the Niger. M. Chudeau brings back an entirely favorable report. Irrigation has made considerable advancement. Lake Faguibine, west of Timbuktu, nearly desiccated during recent years, has been almost completely refilled, thanks to skillful engineering works supplemented by the winter flood of 1915. The future of the cattle industry is also bright. Already some 100,000 head of cattle are brought to market from the neighborhood of the forestal zone. A cold storage and packing plant has already been established, and the erection of others is projected.

The Diary of a Trader in South Africa. Through the generosity of Mrs. Mary L. McKiernan the Society has come into possession of the manuscript diaries and notes of her husband, Gerald McKiernan, who made a number of extremely interesting trading journeys in South Africa from 1874 to 1879. The record covers three main journeys: a hunting and trading trip in Damara Land and Ovambo Land (1875-76); an expedition to Lake Ngami (1877-78); and a trip to the Okavango River (1878-79).

The journey from Walfish Bay northeastward across the Kalahari Desert to Lake Ngami is of chief interest. The wagon route led from water hole to water hole along the beds of streams, across the great "thirst," as the Kalahari is often called, and so to the marshes and mud flats of the lake. Trade was by barter, the bullock carts taking in general merchandise and bringing out ivory. There are vivid descriptions of the native life about Lake Ngami and its tributary streams, the trade in maize, and the strange isolated life of the hunters and traders of every sort who at great hazard made long trips to remote and unexplored districts, where a highly profitable trade was often possible. There are also admirable descriptions of the incredibly immense herds of wild animals that grazed on the undisturbed grasslands north of the Okavango River in the region that corresponds in character and position with the Sudan on the northern edge of the tropical forest of Central Africa. From South Africa bands of Boers trekked northward, trading at native commercial centers, stopping now and then to grow a crop of grain or vegetables or waiting in bands of one or two hundred in some good hunting spot until the rains came and the next "thirst" became possible to cross. The traders were in occasional contact with them all the way from Ngami northward to Portuguese West Africa.

Among published accounts by other traders and travelers is one by C. J. Andersson which covers nearly the same region ("Lake Ngami, or Explorations and Discoveries

during *Four Years' Wanderings in the Wilds of Southwestern Africa*, New York, 1856). He and Galton tried to reach Ngami from Walfish Bay in 1851 and failed, but in 1855 Andersson went again by the same route and succeeded. It will be remembered that Livingstone discovered the lake in 1849, rumors of it, heard years before, exciting great interest among geographers. The long-delayed discovery of the lake is all the more remarkable in view of the fact that the Orange River had been discovered as early as 1760 and that in 1761-62 a well-equipped exploring expedition penetrated the interior of the Nama country farther north. Still farther north went an expedition in 1791-92 and brought back information about the Damara country. The diary of the first of these two expeditions is now in the British Museum (*The Geography of South-West Africa*, by H. Schlichter, *Scottish Geogr. Mag.*, Vol. 7, 1891, pp. 471-472 and 513-524, with bibliogr.). For a map of Lake Ngami and an authoritative summary of the work of Livingstone and others in the region see "Livingstone and the Exploration of Central Africa," by Sir H. H. Johnston (London, 1912, p. 101). Its discovery led to numerous efforts to reach it from other directions and to deal with the natives who lived about it and whose stocks of ivory attracted many traders. The lake is an important focus of native life, as shown especially well on a map by Passarge (*Die Buschmänner der Kalahari*, Berlin, 1907, p. 19).

McKiernan's account, begun but one year after Livingstone was laid to rest in Westminster Abbey, is of distinct value and should be published for wider distribution. It is a source of reliable data and mirrors with great faithfulness the wild life and the people of a frontier region still awaiting its full development. Unfortunately McKiernan was never able to complete his notes, though they cover the most interesting parts of his experiences. The sickness and privations undergone in Africa so affected his health that he was an invalid for many years and died at Altoona, Pa., on June 3, 1892.

POLAR REGIONS

The Latest News of the Crocker Land Expedition. Through a message brought from Greenland to Copenhagen by Surgeon H. J. Hunt and cabled thence to America by the United States Minister to Denmark, direct word has been obtained from MacMillan, leader of the Crocker Land Expedition. He gives an interesting report of his latest journey over glacier-capped islands and across sea ice west of Etah, his base camp, to his farthest point, 103° W. on Finlay Island. The journey covered 1,350 miles and occupied 56 days. The accompanying map gives the route as nearly as can be shown from the brief cabled report.

It is most encouraging, after the many misfortunes that have befallen the expedition, to have so promising a report of actual results accomplished. The determination of the geographical positions of new islands, and of hitherto uncharted portions of coasts, known only through distant sights by much earlier explorers, is a real contribution. And if the published accounts are correct in assigning a latitude of 78° 18' to the large island just east of Amund Ringnes Island, some of our best maps of this region will have to be remade. Among the more important results achieved in the journey across Ellesmere Island are observations on the extent of the glacier ice, the abundance of game, and the existence of "much coal." The party traveled from Ellesmere Island to Cape Southwest at the southern end of Axel Heiberg Island and thence westward to Amund Ringnes Island and finally to Finlay Island, where game became scarce and the lack of dog food compelled a return. Finlay Island and adjacent land masses are reported to show evidences of recent uplift on all shores—a valuable observation when ultimately shown on the maps of the expedition, since it will give us an important basis of comparison with the raised beaches and terraces of northwestern North America and particularly Labrador. The extent of the rise of the land since the removal of the great ice load of glacial times is one of the significant current problems of glaciology.

A third relief ship has sailed, and the news from MacMillan confirms the wisdom of that plan, for MacMillan says that there is food enough to last only until August, after which, should no relief come, the party would have to adopt the Eskimo style of living. Captain Robert A. Bartlett is in command of the third relief ship, the *Neptune*, a steam sealer especially chartered for the purpose, which left New York late in June with more than a year's provisions. Under his competent direction the safe and early return of the expedition is assured.

Dr. Hunt arrived in New York on June 20 and gave details of his own trip. In company with Ekblaw he went from Etah as far as South Upernivik, where Ekblaw remained. From South Upernivik Dr. Hunt traveled only with Eskimos and from Egedesminde to Holstensborg the journey was made by kayak. At the latter place he took a steamer to the Faroe Islands and Copenhagen, returning to this country via Christiania.

Dr. Hunt's journey over the thin ice of Melville Bay was unusually perilous, and the whole sledge trip of 1,400 miles, lasting from December 18, 1916, until April 16, 1917, was no less than an heroic achievement. Polar bear and narwhal meat was obtained

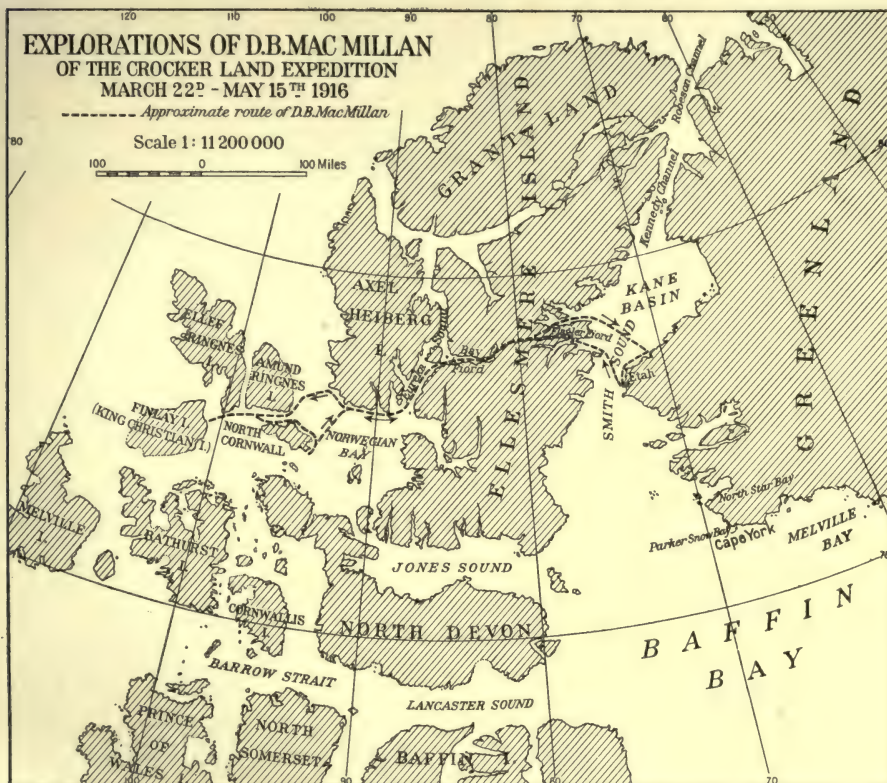


FIG. 1—Sketch-map showing the route of D. B. MacMillan of the Crocker Land Expedition, March 22 to May 15, 1916. Scale, 1:11,200,000.

from Eskimo caches. At night the party camped under the lee of icebergs. Five of the dogs died of starvation.

It is clear from Dr. Hunt's report that the whole account of the hardships, explorations, and scientific results of the expedition will be full of interest and an adequate recompense for the trials and disappointments of the party in carrying out plans in the face of great difficulty.

HUMAN GEOGRAPHY

Early Cultural Migrations and Their Criteria. Under the title of "Ships as Evidence of the Migrations of Early Culture" (reprint from *Journ. Manchester Egyptian and Oriental Soc.*, 1915-16, 42 pp.) Dr. G. Elliot Smith again attacks the problem of the spread of early cultures. Among his numerous publications on this subject two recent papers may be mentioned: "The Origin of the Pre-Columbian Civilization of America" (*Science*, Vol. 44, 1916, pp. 190-195, with map) and "On the Significance of the Geographical Distribution of the Practice of Mummification: A Study of the Migrations of Peoples and the Spread of Certain Customs and Beliefs" (*Memoirs and Proc. Manchester Lit. and Philos. Soc.*, Vol. 59, Part II, 1915, No. 10, 143 pp., with maps).

Dr. Smith is a brilliant and facile writer who scores a point every time he crosses swords with an opponent; and he never writes a dull line. But his essays are strongly reminiscent of the slam-bang type of scientific discussion in vogue in America a half

century and more ago when scientific writings were largely polemic in nature: "puerile and unsatisfying" as the fetish of an African negro are the arguments of an opponent, or "childish subterfuges"! But the arguments of Dr. Smith are forensic and legalistic; his conclusions are not judicial. When an opponent (in a *scientific* debate) uses the phrase "burden of proof" it suffices not to reply, through the medium of strictly a *priori* argument, that the burden of proof rests on him. The burden rests equally upon both, who should abandon argumentation for facts and forsake counter-attack for well-reasoned deduction. It is the truth and not the frenzy of battle which the scientist cares to see.

If one start with the theory that "man has ever groped in the dark" and that similarity of invention, of ritual, and of "bizarre practices and beliefs" among widely separated peoples is conclusive proof of a common origin in some strangely endowed central group, then there is no difficulty whatever in "proving" that Egypt was the point of origin for the reed *balsa* on Lake Titicaca, the megalithic ruins of Easter Island, and the practice of mummifying the dead in India. Granted that the opposing theory of "the similarity of the working of the human mind" is "a soporific drug against the need for mental exertion" it does not establish Dr. Smith's theory to have his opponent's theory destroyed. The reader inevitably shares the author's amazement over some of the stupid replies which critics have made to his contentions; but the beam in Dr. Smith's eye is only too apparent to the bystander, as when he says (to take one of many similar illustrations) there is "no room for doubt that the Burmese type of ship was actually modeled on the plans developed in Egypt in the Pyramid Age."

No one who has lived among the Polynesians and the Amerinds will deny cases of striking ethnological resemblances between Polynesians and Malaysans on the one hand and between the Indians of Mexico and Peru and the people of Eastern Asia on the other. But anthropogeographical science is not promoted by the mere assertion of such resemblances. Every traveler makes the observation. But what are the convergent facts? Is it not cogent to say that the time required by the people of the New World to domesticate maize, the potato, and the llama and develop a wonderful originality of design in weaving was long enough to enable them to learn terraced irrigation and that dried reeds tied in bundles will float a man? Is a granite cliff less suggestive to the primitive mind in developing a wall of trimmed rock for defence or shelter than a faint ancestral memory of great hewn stones on a remote Pacific island?

The world would indeed be too small to hold the books required to advance science if the human mind depended exclusively upon those circuitous methods of thought which we have outlined. There is so much of erudition and vital truth in this paper that we who have far less imagination and argumentative power wish Dr. Smith had more.

GEOGRAPHICAL NEWS

The Growth of General Geographical Interest and the War. Serious interest in geography has been greatly increased by the war, as readers discover the geographical basis of military campaigns, the meteorological aspects of airplane work and scouting in general, and the necessity for persistent map study to understand the sequence of battles and campaigns over extended fronts in widely separated localities. Never before has there been so great a demand for really authoritative and scientific articles on war problems of current importance. This interest is undoubtedly permanent and will develop still more after the war, when new commercial relations become established and foreign lands again attract the traveler and the commercial explorer.

The development of general interest as manifested through the activities of this Society is marked by rapid growth in numbers (the membership has trebled in less than a year), through a vastly increased correspondence, and through a steadily rising standard of literary style and scientific content on the part of contributors to the *Geographical Review*.

"Travel," published by the Travel Club of America, is now one of the best of the illustrated popular magazines. Its octavo size permits excellent reproductions of large-scale photographs, and its enterprising editors are securing some of the best available material on the scenic aspects of travel. The June number is typical; three articles are especially noteworthy:

Mukuntuweap: A Desert Yosemite, by Guy Elliott Mitchell
 Along the Columbia River Highway, by Mark Woodruff
 Denver's Romantic Mountain Parks, by Edgar C. MacMechen

The Travel Club of America aims to make the world more widely known through the media of photographs and popular descriptive accounts. Its success indicates not only an energetic management but also a sound guiding principle in the popular education of the time.

PERSONAL

ASSOCIATE PROFESSOR N. A. BENGTSON of the University of Nebraska will devote three months this summer to geological reconnaissance work in the foothill region of the Rocky Mountains in Montana, Wyoming, and Colorado and in the adjacent portion of the High Plains.

PROFESSOR ELIOT BLACKWELDER of the University of Illinois is at present in California as a geological member of an advisory commission appointed by the Governor of California to investigate the petroleum resources of the state, their production and utilization. Beginning late in July Professor Blackwelder expects to spend six or eight weeks in the Laramie Range in southeastern Wyoming with a class of graduate students.

PROFESSOR J. E. CHURCH, JR., of the Department of Meteorology of the University of Nevada, has just completed two publications, one on "Snow Surveying: Its Problems and Their Present Phases" and the other on "The Evaporation of Snow." A third publication, on "The Relation of Mountains and Forests to the Conservation of Snow," will be issued in the winter. Professor Church has also begun, in co-operation with the U. S. Reclamation Service, an investigation of the relation of weather to run-off.

PROFESSOR F. E. CLEMENTS of the University of Minnesota is in the West and will devote the summer largely to grazing problems in connection with the national emergency. Incidentally he hopes to complete the task of securing material for a monograph he is planning to write on the bad lands.

DR. O. E. JENNINGS of the Carnegie Museum of Pittsburgh will spend the summer in botanical exploration and collecting along the eastern shore of Lake Nipigon, the large lake in Ontario immediately north of Lake Superior, and thence eastwards to Long Lake, some sixty miles distant.

ASSISTANT PROFESSOR WELLINGTON D. JONES of the University of Chicago has returned from his trip to the Far East (see the *Geogr. Rev.*, Vol. 2, 1916, p. 75). The main purpose of the trip was to gain a first-hand knowledge of the essentials of the geography of eastern Asia. Dr. Jones traversed the length of the Japanese Islands from central Yezo to Kiushiu, Korea from south to north, and southern Manchuria, including the Liaotung Peninsula. In China Dr. Jones went from Peking to Kalgan up onto the edge of the Mongolian Plateau for a few days trip. Dr. Jones then traversed China from north to south from Peking to Canton, with a side trip to Taiyuan in Shansi Province. South of Hankow the route led up the Yangtzekiang and through Tungting Lake and up the Siang River to Changsha, whence Dr. Jones continued overland along the line of the proposed railway. Some work in the delta region of the Sikiang between Canton and Hongkong followed, then a steamer trip from Hongkong to Shanghai and a few days in the Shanghai region of the Yangtzekiang delta.

MR. THOMAS H. KEARNEY of the Bureau of Plant Industry of the U. S. Department of Agriculture expects to continue during the present summer, in co-operation with Dr. H. L. Shantz of the U. S. Department of Agriculture, the studies of native vegetation as an indicator of the agricultural capabilities of land in the western states which have been in progress during the past five or six years. Detailed investigations of this subject have been made in the Great Plains region (eastern Colorado), in the Great Basin region (Toole Valley, Utah), and in the Southwestern Desert region (Cahuilla Valley, Cal., and Salt River Valley, Ariz.). In all of these localities close correlations have been established between the natural plant associations, the physical characteristics of the underlying soils, and their relative capabilities for crop production under irrigation or by dry-farming methods. Reconnaissance work in other parts of the Great Plains, the Inter-Mountain region, and the Southwestern Desert region have indicated that the correlations worked out in detail in the localities mentioned will hold good over extensive areas with comparatively slight modification. It is believed that these investigations have furnished a method for the rapid and accurate classification of untitled land in the more arid portion of the United States with respect to its possible agricultural value. During the present season these investigations will be continued in southern Arizona and probably in New Mexico, Oregon, and Washington.

DR. DAVID RANDALL-MACIVER, late librarian of this Society, has for some time been at the front with the British Army in Greece.

MR. J. B. TYRRELL, mining engineer of Toronto, at one time connected with the Geological Survey of Canada, expects to spend part of the summer in the mining district north of the Saskatchewan River in Manitoba.

DR. T. WAYLAND VAUGHAN of the U. S. Geological Survey has been in charge during the past year, for the Smithsonian Institution, of the preparation of memoirs to be published as a result of a co-operative arrangement made in 1912 between the U. S. Geological Survey, the Smithsonian Institution, and the Isthmian Canal Commission for the prosecution of geological investigations in the Canal Zone and adjacent areas in Central America. Dr. Vaughan has completed the following monographs: "Corals"; "The Biologic Character of the Sedimentary Formations of the Canal Zone and Adjacent Areas in Central America" (with D. F. MacDonald); and "The Geologic Correlation of the Sedimentary Geologic Formations of the Canal Zone and Adjacent Areas in Central America and Their Bearing on the Geologic History of the Perimeters of the Gulf of Mexico and the Caribbean Sea." As one in this series of publications Dr. D. F. MacDonald, geologist of the Isthmian Canal Commission, has completed a comprehensive monograph on the physiography, stratigraphic, structural, and economic geology of the Canal Zone and adjacent areas.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

General

BRADLEY, G. D. **The story of the Pony Express: An account of the most remarkable mail service ever in existence, and its place in history.** 175 pp.; ill. A. C. McClurg & Co., Chicago, 1914. 75 cents. 7 x 4½.

Mr. Bradley describes this book as an account of the most remarkable mail service that ever existed. The Pony Express, between the Missouri River and the Pacific Coast, spanned the interval between April, 1860, when the trans-continental telegraph extended to St. Joseph, Missouri, and October, 1861, when it was completed and messages were sent by wire from coast to coast. Previous to this time communication had been only by a semi-monthly steamship service between New York and San Francisco, via Panama, the trip taking four weeks; or by the Butterfield Overland Mail, established in 1858, from St. Louis by way of El Paso and Fort Yuma to San Francisco on a twenty-five day schedule. When it was seen that civil war between the states was inevitable, a great deal of anxiety was felt both in Washington and amongst the loyalists of California over the possible loss of that state to the Union. To avert this and keep the East and West in touch the Pony Express was organized.

The freighting and stage firm of Russell, Majors, and Waddell of Leavenworth, Kansas, deserves the credit for this enterprise, which they planned without Government aid and in realization of the probability of financial loss, a fear that indeed came true. Mr. Bradley estimates the total loss in the year and a half of its service as \$200,000, and this in spite of a postal rate of \$5 an ounce. The pony riders had normal runs of seventy-five miles, with changes of mounts every ten miles. Including stops, an average speed of ten miles an hour was to be maintained on the summer schedule. Accidents of weather or attacks by Indians, sometimes on the pony riders but more often on the lonely station keepers, frequently interfered with the schedule. To bring the mail in on time in spite of disasters on the road became almost a religious duty. Many riders far exceeded their normal runs. The late Wm. F. Cody is credited with the longest continuous ride, three hundred and twenty-two miles. The regular time of the Pony Express was ten days from St. Joseph to Sacramento, about half the time then required by the Butterfield stage, which continued to be used for passengers, freight, and slower mail. The high rate necessarily charged by the Pony Express caused its use to be confined chiefly to newspapers, large commercial houses, and the United States Government. The British Government also made use of it for communications between London and the Chinese coast. The best record ever made by the express was in March, 1861, when the President's inaugural message was carried from St. Joseph to Sacramento, 1,966 miles, in seven days and seventeen hours.

The author concludes with a well-deserved tribute both to the managers of the Pony Express, who performed a most important service to the country, and to the daring pony riders, who furnish a record of pluck and devotion to an ideal which does them lasting honor, altogether an enduring tribute to American courage and American organizing genius. With no attempt at literary style this book is still a clear and interesting account of an important incident in the development of the United States. R. S. HARVEY.

JONES, G. M. **Ports of the United States: Report on terminal facilities, commerce, port charges, and administration at sixty-eight selected ports.** 431 pp.; maps, diagrs. *Bur. of Foreign and Domestic Commerce, Misc. Ser. No. 33.* Dept. of Commerce, Washington, D. C., 1916.

In view of the interest in port development and water transportation in the United States, this compilation is timely. It brings up to date the official report on this subject in Part III of the "Report on Transportation by Water in the United States," issued by the Bureau of Corporations in 1910.

Mr. Jones visited the ports on the Atlantic Coast, the Gulf of Mexico, and the Great Lakes, and sent an inquiry schedule to the mayors of 576 cities. The ports of which

he writes are those which have a "water-borne commerce," amounting to one million short tons in volume, or \$30,000,000 in value, in the calendar year 1913. For each port so described he gives a physical description and details regarding railroads, steamship connections, statistics of the port's commerce, extent and ownership of the water front, terminals, kind of wharf construction, and port charges. Particularly valuable is the collection of maps of the more important ports.

A fault of the book is that it does not get anywhere. It is a great mass of facts, gathered with no apparent purpose in view. The facts are not used to develop any theory of port ownership or port operation. It is not a handbook for engineers, for port authorities, or for shippers. As an economic work, it almost totally disregards the most important factor in the competition of our various Atlantic and Gulf ports, viz., the relative rates to and from the interior points. A port today is a commercial and not a geographical fact. Geographical factors may have determined its locality, but its ability to get and hold business depends upon the inland and ocean rates which it enjoys and the charges which various commercial agencies levy upon goods that pass through it.

The shipper will look in vain for information regarding rate structures, inland and ocean, grain elevation charges, the presence or absence at the seaboard of necessary forwarding agencies at the various ports; and port authorities examining the work will find little guidance as to the question of public versus private ownership of waterfront facilities. This Government report is better than many, but it shares their usual fault of comparative lack of aim and of attainment.

EDWIN J. CLAPP.

MARVIN, C. F. **Report of the chief of the Weather Bureau, 1914-1915.** 276 pp.; maps. U. S. Dept. of Agric., Weather Bureau, Washington, D. C., 1916.

It is inevitable that an official Government report, like that of the Chief of the Weather Bureau, should appear a good while after the period of activities and observations which it covers. Nevertheless, there is always much of interest in this report, and those who are working along meteorological or climatological lines may perhaps occasionally need to be reminded of the appearance of this annual volume, and of what it contains. The "Review of Weather Conditions during the Year" summarizes briefly the essential meteorological characteristics, in a compact form, convenient for reference. Four charts show the departure from the normal temperature for the crop season (March 1-Sept. 30); the total precipitation for the crop season; the departure from the normal precipitation for the crop season, and the total precipitation of the year. The monthly amounts of sunshine and the percentages of the possible sunshine, as derived from thermometric recorders, are given for 148 stations. Excessive rainfalls are tabulated in full in another table. The monthly and annual meteorological summaries for 204 stations cover 100 pages. The monthly and annual precipitation is given for all stations (48 pp.), and the monthly and seasonal snowfall for selected stations (53 pp.). Teachers will find abundant material for study and for illustration in the pages of these successive reports.

R. DEC. WARD.

BALL, M. W., AND L. W. STOCKBRIDGE. **Petroleum withdrawals and restorations affecting the public domain.** 427 pp.; maps. U. S. Geol. Survey Bull. 623. Washington, D. C., 1916.

BEAL, F. E. L., W. L. MCATEE, AND E. R. KALMBACH. **Common birds of south-eastern United States in relation to agriculture.** 39 pp.; map, ills. *Farmers' Bull.* 755. U. S. Dept. of Agric., Washington, D. C., 1916.

BEARD, C. A. **Economic origins of Jeffersonian democracy.** ix and 474 pp.; index. The Macmillan Company, New York, 1915. \$2.50. 9 x 6.

BLAIR, W. R., AND C. S. WOOD. **Meteorological observations on board the U. S. Coast Guard Cutter "Seneca," April to July, 1915.** Maps, diagrs., ills. *Monthly Weather Rev. Suppl. No. 3*, pp. 13-28. Weather Bureau, Washington, D. C., 1916.

CAPRA, GIUSEPPE. **Le città della Federazione Nord-Americana.** *Boll. della Reale Soc. Geogr. Italiana*, Vol. 5, 1916, No. 9, pp. 737-748.

CARDEN, G. L. **Address on the U. S. Coast Guard and inland navigation.** *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 147-155. Philadelphia, 1915.

— **Climatological data for the U. S. by sections, (1) January, (2) March, (3) July, (4) August, (5) September, (6) October, (7) November, 1916; (8) January, 1917 (Vol. 3, Nos. 1, 3, 7, 8, 9, 10, 11; Vol. 4, No. 1).** Maps. U. S. Weather Bur. [Pubs.] Nos. 573, 578, 593, 595, 597, 601, 576, 608.

— **Coal industry of the United States in 1915.** The. ills. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 274-276.

— **Copper production in the United States in 1915.** Diagr., ill. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 245-253.

— **Cyclone in perspective.** A. Map. *Monthly Weather Rev.*, Vol. 44, 1916, No. 10, p. 581.

DABNEY, A. L. **Mississippi River flood records studied with relation to levee grades: By raising embankment elevations 6 to 7 feet menace from extreme high water would be effectively removed.** Map, diagr. *Engineering Rec.*, Vol. 73, 1916, No. 14, pp. 452-455.

DANA, S. T. **Farms, forests, and erosion.** 28 pp.; ill. *Separate 688 from U. S. Dept. of Agric. Yearbook*, 1916. Washington, D. C., 1917.

DANIELS, G. W. **American cotton trade with Liverpool under the Embargo and Non-Intercourse Acts.** *Amer. Historical Rev.*, Vol. 21, 1916, No. 2, pp. 276-287. [1807 to the war of 1812.]

DEMING, W. C. **Nut growing, a new American industry.** Ills. *Amer. Forestry*, No. 266, Vol. 22, 1916, pp. 99-104.

FANNING, C. E. **Travel in the United States: Twenty-one programs and bibliography.** 31 pp. (Study Outline Ser.) H. W. Wilson Co., White Plains, N. Y., and New York City, 1916. 25 cents. 8 x 5. [By "travel" is meant mental travel. The bibliography is somewhat restricted in range, the same general works doing service as references on the individual sections of the country.]

— **Geographic Board of the United States: Decisions, Dec. 1915-Feb. 1916.** 6 pp. Washington, D. C., 1916.

GLADDING, E. P. **Across the continent by the Lincoln Highway.** 262 pp.; map, ill. Brentano's, New York, 1915. \$1.50. 8 x 5½.

— **Gold in the United States in 1915, Production of.** Ills. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 234-238.

GRAVES, H. S. **Report of the Forester.** 36 pp. From *Annual Report of Dept. of Agriculture for 1916*, Washington, D. C. [One of the most important government reports, at least from a geographic standpoint, is that of the Chief Forester, whose compact descriptions and statistical tables give one a vast amount of information about the condition of the forests, their relation to grazing, the extent of reforestation, water-power in the valleys, the development of roads and trails, and research problems that tend to extend the usefulness of the forests and the Forest Service. To characterize the report is practically to quote it in its entirety. It is a document of great geographical value which ought to be utilized by every geographer who wishes to make his subject contribute to the broad questions of public service.]

GROVER, N. C., AND J. C. HOYT. **Accuracy of stream-flow data.** *U. S. Geol. Survey Water-Supply Paper 400-D (Contributions to the Hydrology of the United States, 1916, pp. 53-59).* Washington, D. C., 1916.

GROVER, N. C., G. C. STEVENS, AND W. E. HALL. **Surface water supply of the United States, 1914. Part II: South Atlantic and eastern Gulf of Mexico basins.** 66 and xxx pp.; ill., indexes. *U. S. Geol. Survey Water-Supply Paper 382.* Washington, D. C., 1916.

GROVER, N. C., W. G. HOYT, A. H. HORTON, C. C. COVERT, AND C. H. PIERCE. **Surface water supply of the United States, 1914. Part IV: St. Lawrence River basin.** 128 and xxix pp.; ill., indexes. *U. S. Geol. Survey Water-Supply Paper 384.* Washington, D. C., 1916.

HARPER, R. M. **Development of agriculture in the pine-barrens of the south-eastern United States.** Map. *Journ. of Geogr.*, Vol. 15, 1916-17, No. 2, pp. 42-48.

HOLMES, C. N. **Earlier transportation in the United States.** Reprint from *Granite Monthly*, Vol. 47, 1915, No. 10, pp. 443-445.

HOUSTON, DAVID. **The national forest enterprises.** *Amer. Forestry*, No. 276, Vol. 22, 1916, pp. 750-752.

HOVERSTAD, T. A. **The Norwegian farmers in the United States.** 31 pp.; ill. Hans Jervell Publ. Co., Fargo, N. D., 1915. 7½ x 5½.

HRDLÍČKA, ALEŠ. **Physical anthropology of the Lenape or Delawares, and of the eastern Indians in general.** 130 pp.; maps, diagr., ill. *Bur. of Amer. Ethnology Bull. 62.* Smithsonian Institution, Washington, D. C., 1916.

HULBERT, A. B. **Western ship-building.** *Amer. Historical Rev.*, Vol. 21, 1916, No. 4, pp. 720-733. [On the "first mechanical industry of importance" in the trans-Allegheny country during the first decade of the nineteenth century.]

INGLE, EDWARD. **A year of cotton and other southern crops.** Ill. *Amer. Review of Reviews*, Vol. 52, 1915, No. 2, pp. 199-203.

— **Iron and steel industry in 1915, The.** Ills. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 266-269.

— **Lead and zinc industry in the United States.** Diagr., ills. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 254-260.

— **Lincoln Highway, Progress of.** *Engineering News*, Vol. 75, 1916, No. 14, p. 635.

McCASKEY, H. D. **Mineral production of the United States in 1914 (summary).** 69 pp. Diagr. *U. S. Geol. Survey [Publ.] 1:A.* Washington, D. C., 1916.

McSWEENEY, E. F. **Public control of our water-fronts and the obstacles to be overcome.** *Proc. and Papers of the Fourth Ann. Convention of the Amer. Assoc. of Port Authorities*, 1915, Sept. 13-15, pp. 139-163. Los Angeles, Cal.

MERRITT, EUGENE. **The agricultural element in the population.** [*Quart. Publs. of Amer. Statistical Assoc.*, N. S., No. 113, Vol. 15, 1916, pp. 50-65.]

— **Mineral and metal production in the United States in 1915.** *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 229-230.

— **Modernizing Mississippi River transportation: The new steel barges which usher in the revival of traffic on the great inland waterway.** Diagr., ills. *Scientific American*, Vol. 114, 1916, No. 21, May 20, pp. 531, 539-540.

MOORE, J. H. **Inland waterways from official viewpoints.** 23 pp. Extension of remarks of Hon. J. Hampton Moore of Pennsylvania in the House of Representatives, December 21, 1916. Washington, D. C., 1917.

MORAN, E. L. **The coal traffic of the Great Lakes.** Ills. *Journ. of Geogr.*, Vol. 15, 1916-17, No. 5, pp. 150-159.

MORSE, FREMONT, AND O. B. FRENCH. **Determination of the difference in longitude between each two of the stations Washington, Cambridge, and Far Rock-away.** 40 pp.; maps, diagr., ills. *U. S. Coast and Geodetic Survey Special Publ. No. 35.* Washington, D. C., 1916.

MOULTON, H. G. **Economic aspects of inland water transportation.** *Journ. of Geogr.*, Vol. 15, 1916-17, No. 3, pp. 73-78; No. 4, pp. 112-116.

OAST, J. W., JR. **The growth of barge traffic and some hindrances thereto.** *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 197-203.

— **Our forests in time of war.** *Amer. Forestry*, No. 270, Vol. 22, 1916, pp. 341-344.

— **Peculiarities of streams in flood.** *U. S. Geol. Survey Press Bull. No. 280*, p. 3. Washington, D. C., July, 1916.

— **Petroleum industry in the United States, The.** Ills. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 270-272.

PIERCE, R. C. **The measurement of silt-laden streams.** Diagr. *U. S. Geol. Survey Water-Supply Paper 400-C (Contributions to the Hydrology of the United States, 1916, pp. 39-51).* Washington, D. C., 1916.

SOUTH AMERICA

THE GUIANAS, VENEZUELA, COLOMBIA

ROOSEVELT, THEODORE. **A naturalists' tropical laboratory.** Map, ills. *Scribner's Mag.*, Vol. 61, 1917, No. 1, pp. 46-64.

Chiefly narrative and biological in character, this article contains also some interesting and important descriptions in the field of plant and animal geography. Readers of the former *Bulletin* of this Society will recall Angelo Heilprin's enthusiastic account of the tropical jungle in British Guiana (Impressions of a Naturalist in British Guiana, *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, pp. 536-556). To those interested in tropical forests it may be said that there exist few descriptions as good as this paper contains of the intense struggle for life among the forest trees and plants in the tropics. The following quotation is especially noteworthy and refers to the forest near Kalacoon, British Guiana.

"The trees stand close together, tall and straight, and most of them without branches, until a great height has been reached; for they are striving toward the sun, and to

reach it they must devote all their energies to producing a stem which will thrust its crown of leaves out of the gloom below into the riotous sunlight which bathes the billowy green upper plane of the forest. A huge buttressed giant keeps all the neighboring trees dwarfed, until it falls and yields its place in the sunlight to the most instantly vigorous of the trees it formerly suppressed. Near the streams the forests are almost impassable, so thick is the tangle below; but away from the streams the walking is easier, because only a few bushes and small trees grow in the perpetual shade. To the new-comer one unending wonder is the mass of vines, the lianas, or bush-ropes; everywhere they hang from the summits of the trees, or twist round the trunks, or lace them together. A few kill the trees; most seem to do them no damage. Some are huge, twisted, knotted cables, dragging down the branches around which they are wrapped, and themselves serving as supports for lesser vines that twine around them. Others stretch up, up, as straight and slender as the shrouds of a ship, until they are lost overhead in the green ceiling of interlocked leaf and branch."

The second part of the paper deals with zoölogical observations on the island of Trinidad.

BOLINDER, GUSTAF. *En etnologisk forskningsfärd i norra Columbia, 1914-1915.* Ills. *Ymer*, Vol. 36, 1916, No. 3, pp. 175-193.

BOOY, THEODOOR DE. *Island of Margarita, Venezuela.* Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 4, pp. 531-546. [The aridity of the greater part of the island turns the attention of the inhabitants to the sea as a source of livelihood, a geographic response suggesting comparison with the Bahamas. As of old, the pearl fisheries still constitute the most valuable industry, though signs of their exhaustion are apparent.]

CHEERIE, G. K. *A contribution to the ornithology of the Orinoco region.* *Science Bull.*, Vol. 2, 1916, No. 6, pp. 133-174. Museum of Brooklyn Inst. of Arts and Sciences.

HUFFNAGEL, G. E. *De tragedie der verschepping van de Surinaamsche bacoven.* *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 5, pp. 181-196.

KNOBEL, F. M. *Suriname.* *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 10, pp. 490-494.

MASON, C. T. *The mighty cataract of Kaieteur.* Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 3, pp. 47-48.

MELL, C. D. *The greenheart of commerce.* Ills. *Amer. Forestry*, No. 269, Vol. 22, 1916, pp. 288-291. ["Greenheart is known to occur in British, Dutch, and French Guianas and in parts of eastern Venezuela. The reports that this tree is found in Brazil and in Colombia have not yet been authenticated, but it is quite likely that it grows in Brazilian Guiana near the mouth of the Amazon."]

— *World's neglected larder, The: It lies at the threshold of New York.* Ills. *The South American*, Vol. 4, 1916, No. 5, p. 111. [The pasture lands of Colombia and Venezuela. See also Walter Lefferts: *The Cattle Industry of the Llanos*, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 180-187.]

PARAGUAY, URUGUAY, ARGENTINA, CHILE

GRUBB, W. B. *A church in the wilds.* Edit. by H. T. Morrey Jones. xv and 287 pp.; maps, ill., index. E. P. Dutton & Co., New York, 1914. 8 x 5½.

The geographical content of this volume is largely identical with that of the author's earlier work, "An Unknown People In An Unknown Land" (reviewed in the *Bull. Amer. Geogr. Soc.*, Vol. 43, 1911, p. 458). Interest however is concentrated, as the title suggests, more strongly upon religious aspects. The introductory chapter emphasizes the unique circumstances in which the mission is placed. When the first workers entered, the Paraguayan Chaco was an unexplored country inhabited by independent savage tribes regarding whom most unpleasant traditions existed. The first mission station was within "sound of the whistle of the modern mail steamer on the River Paraguay," yet for all practical purposes it was hundreds of miles from civilization. The entire region is scantily populated. In the area claimed by Paraguay there are perhaps 30,000 to 35,000 people, but the Bolivian frontier is still undefined, and, if the claims of Bolivia are recognized, the number is reduced to not more than 20,000, embracing the Lengua-Maseoy, the Suhin, and three minor tribes. Even this scant population of roughly less than one person to two square miles is diminishing except among the Indians directly connected with the mission. The improvement among the mission Indians is largely due to a determined campaign against the custom of infanticide, a practice natural enough among a nomadic people in a land of limited and uncertain resources. Consideration of the destiny of the Chaco tribes forms an appropriate conclusion to the volume. The

question is becoming acute, for civilization in the form of exploitation of *quebracho* forests, of sugar plantations, and of cattle ranches is fast approaching, especially from the Argentine. One of the great problems of such advance is that of the labor supply. If properly treated the Chaco Indian proves a good workman, and the incoming race should consider his preservation from an economic as well as an ethical standpoint.

ABELLA, ARTURO. *Dairying in Uruguay*. *Monthly Bull. of Agric. Intelligence and Plant Diseases*, Vol. 7, 1916, No. 5, pp. 629-637. Internatl. Inst. of Agric., Rome.

ALBES, EDWARD. *Punta Arenas, the world's southernmost city*. Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 4, pp. 465-479. [Punta Arenas, boasting 13,000 inhabitants, has quadrupled in size during the last two decades. Expansion has followed the great ovine development in Magallanes: 35 years ago the territory possessed only 185 head of sheep, now they are estimated at over 2,000,000. Wool is the principal export, accounting for more than half of the five million dollars' worth of Chilean exports. Refrigerated and canned meats, the output of three potting and refrigerating plants, account for nearly half of the remainder. Timber sent to Argentina or to the Falkland Islands is also assuming some importance on the export list. In addition, Punta Arenas ships produce for the contiguous Argentine territory.]

ARAÚJO, ORESTES. *Geografía económica del Uruguay*. xi and 216 pp.; ill. A. Monteverde y Cía, Montevideo, 1910. 8 x 5½.

— *Argentina, República, Memoria del cónsul general de Chile en la, correspondiente al año 1915*. *Bol. de Relaciones Exteriores* No. 64, pp. 33-53. Santiago de Chile, 1916.

— *Argentina, The population of the*. *Amer. Review of Reviews*, Vol. 54, 1916, No. 4, p. 451. [Review of an article on this topic (the ethnic character of the population) by José Ingenieros in the *Revista de Filosofía*, Buenos Aires.]

— *Argentine foreign trade, Route of*. *South Amer. Journ.*, Vol. 80, 1916, No. 24, pp. 484-485.

— *Argentine Republic, The*. 82 pp. Guaranty Trust Company of New York, 1916. 7 x 5. [One of a series of pamphlets on foreign trade issued by this company.]

BEDER, ROBERTO. *Estudios geológicos e hidrogeológicos en los alrededores de Villa Dolores (provincia de Córdoba)*. 37 pp.; maps, diagrs., ill. *Bol. Direcc. Gen. de Minas, Geol., e Hidrol. No. 14, Ser. B (Geol.)*. Minist. de Agric., Buenos Aires, 1916. [Villa Dolores lies west of the Sierra de Córdoba on the border of the arid region comprised by the provinces of Mendoza, San Luis, and La Rioja. Geological and hydrographical sketch maps and sections illustrate the project for irrigation dependent on the proposed dam of La Viña in the Río de los Sauces.]

BEDER, ROBERTO. *Los yacimientos de los minerales de wolfram en la República Argentina*. 31 pp., map, bibliogr. *Bol. Direcc. Gen. de Minas, Geol., e Hidrol. No. 12, Ser. B. (Geol.)*. Minist. de Agric., Buenos Aires, 1916. [With a bibliography and a map showing the terrane of the Pampean Sierras and the associated deposits of wolframite.]

BODENBENDER, GUILLERMO. *El Nevado de Famatina*. Diagrs. *Bol. Acad. Nac. de Ciencias en Córdoba (República Argentina)*, Vol. 21, 1916, pp. 100-182. Buenos Aires. [This study is a continuation of the geological investigation carried on by the author in the southern part of the province of La Rioja. The Nevado de Famatina (29° S.) is the culminating height (19,700 feet) of the Sierra de Famatina, which runs in a north-to-south direction through Catamarca and La Rioja from the *altiplanicie* of Atacama. With the great development of cretaceous eruptive material are associated the famous mineral deposits of this part of the Sierra. The author precedes his detailed geological description with a chapter on topography, vegetation, distribution of population, and local mining conditions.]

— *Boletín mensual, Mayo de 1916 (Vol. I, No. 5)*, 44 pp.; maps, diagrs. Oficina Meteorol. Nac., Buenos Aires, 1917.

BRÜGGEN, J. *Informe sobre el carbon submarino en la costa de la provincia de Arauco*. 7 pp. *Soc. Nac. de Minería*, Santiago de Chile, 1914.

BRÜGGEN, J. *La formación de los carbones de piedra, especialmente de los chilenos*. 39 pp.; map, diagrs. Soc. Imprenta-Litografía "Barcelona," Santiago-Valparaíso, 1916. [The coal of Arauco is of Tertiary (late Oligocene and Miocene) age. Its formation appears to have taken place under conditions analogous to those governing the genesis of the peat deposits of Holland.]

CARDOSO, ANÍBAL. *El Río de la Plata desde su génesis hasta la conquista*.

Maps, diagrs. *Anal. del Museo Nacl. de Hist. Nat. de Buenos Aires*, Vol. 27, 1915, pp. 153-284. Buenos Aires. [Abstracted in the *January Review*, pp. 70-71.]

CAZOTTE, J. V. *Memoria anual del cónsul de Chile en Salta correspondiente al año próximo pasado*. *Bol. de Relaciones Exteriores* No. 65, pp. 23-33. Santiago de Chile, 1916.

— **Chile, Anuario estadístico de la República de:** Vol. 1, *Demografía*, año 1914, xv and 92 pp.; Vol. 3, *Política y administración*, año 1914, 168 pp.; Vol. 8, *Industrias*, año 1914, 52 pp.; Vol. 9, *Comercio y comunicaciones*, 1a Parte—*Movimiento marítimo*, año 1914, vii and 113 pp.; Vol. 10, *Agricultura*, año 1914-15, 308 pp. Oficina Central de Estadística, Santiago de Chile, 1915, 1916.

— **Chile, Estadística comercial de la República de, año 1915.** xxi and 333 pp. Oficina Central de Estadística, Valparaíso, 1916.

— **Chile, Statistical synopsis of the Republic of.** 107 pp.; maps, diagrs. Oficina Central de Estadística, Santiago de Chile, 1916.

DAVIS, W. G. **Argentine Meteorological Service: History and organization, with a condensed summary of results.** 181 pp.; maps. Buenos Aires, 1914. [In Spanish and English.]

DOERING, ADOLFO, AND P. G. LORENTZ. **Recuerdos de la expedición al Río Negro (1879).** *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 21, 1916, pp. 301-386. [The authors accompanied the military expedition that opened up the Argentina South; the former as zoölogist, the latter as botanist. Shortly after the return of the expedition the scientific results were published in part (*Actas de la Academia Nacional de Ciencias*, Vol. 3) but lack of funds prevented completion. The diary, with observations upon the surficial geology, hydrography, and vegetation here appears for the first time.]

DOERING, OSCAR. **Observaciones magnéticas efectuadas fuera de Córdoba durante el año 1899.** *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, pp. 1-96. Buenos Aires.

DOERING, OSCAR. **Observaciones magnéticas efectuadas fuera de Córdoba en los años 1901, 1902 y 1903.** *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, pp. 113-150. Buenos Aires.

DOERING, OSCAR. **Observaciones magnéticas efectuadas fuera de Córdoba en el año 1904.** *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, pp. 235-294. Buenos Aires.

— **Estadística minera de la República:** (1) año 1912, 34 pp.; (2) año 1913, 52 pp.; (3) año 1914, 51 pp.; diagrs. in all. *Bol. Direcc. Gen. de Minas, Geol., e Hidrol., Ser. A (Minas)*, Nos. 4, 5, 7. Minist. de Agric., Buenos Aires, 1915, 1915, 1916.

FELSCH, JOHANNES. **Informe preliminar sobre los reconocimientos jeológicos de los terrenos petrolíferos de Magallanes del Sur, Diciembre de 1915 a Junio de 1916.** Map, diagrs. *Bol. Soc. Nacl. de Minería*, No. 223, Vol. 28, 1916, pp. 214-223; No. 224, pp. 309-314. Santiago de Chile. [With a black-and-white geological map, 1:250,000, of the Strait of Magellan region.]

FURLONG, C. W. **The people of Tierra del Fuego.** Ills. *Travel*, Vol. 27, 1916, No. 5, pp. 25-28. [See the same writer's articles on this topic in the *Geogr. Rev.* for January and March, 1917.]

GOEHRING, MAURIZIO. **La yerba mate o thè del Paraguay e l'alto suo valore nutritivo.** *L'Esplorazione Commercio*, Vol. 31, 1916, No. 4, pp. 121-126.

HOSSEUS, C. C. **La difusión geográfica de Araucaria imbricata R. et P.** *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, pp. 351-361. Buenos Aires.

HOSSEUS, C. C. **Observaciones arqueológicas en el río Blanco (San Juan).** Ills. *Anal. del Museo Nacl. de Hist. Nat. de Buenos Aires*, Vol. 28, 1916, pp. 145-151.

KEENA, L. J. **Chile.** 12 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 41a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C. [Closing of the Panama Canal and high freight rates through the Straits of Magellan seriously handicapped both export and import trade. "Some idea of the difference in the cost of carrying merchandise via the Straits and via the Canal may be gathered from the present cost of a time charter—say \$1,500 per day for a steamer loading 10,000 tons—and the fact that via the Canal the running time from east-coast ports to Chile would be 20 days, as compared with 45 days via the Straits, and that to the daily charter cost must be added all fuel and operation expenses."]

KURTZ, FEDERICO. *Essai d'une bibliographie botanique de l'Argentine*. *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, p. 369. Buenos Aires. [An addendum to the edition of 1912.]

LEHMANN-NITSCHKE, ROBERT. *Noticias etnológicas sobre los antiguos patagones recogidas por la expedición Malaspina en 1789*. *Bol. Acad. Nacl. de Ciencias en Córdoba (República Argentina)*, Vol. 20, 1915, pp. 103-112. Buenos Aires. [The records of Malaspina's world voyage of 1789-1794, published in 1885, lacked the observations on the Patagonian littoral, the manuscripts for which are preserved in the British Museum. These, containing notices upon the manners and customs of the ancient Tehuelches, are here reproduced.]

EUROPE

SCANDINAVIA, INCLUDING FINLAND

BOHEMAN, EZALINE, edit. *Svenska Turistföreningens Årsskrift*. 1915: xvi and 452 pp.; map, diagrs., ill. 1916: 450 pp.; map, ill. Wahlström & Widstrand, Stockholm, 1915 and 1916. 4 kr. each. $8\frac{1}{2} \times 5\frac{1}{2}$.

The attractions of Sweden as a tourist country are not yet so well known to the outside world as those of its sister country, Norway, but within Sweden itself the Tourist Association has guided the stream of summer travelers to seek out the beauties of their homeland. The two yearbooks of the Association are thick books containing hundreds of beautiful illustrations and much useful information presented in readable form. They point the way to what might be done in America if the "See America First" movement could be as well organized. The report for 1915 marks the thirtieth anniversary of the association and recapitulates its aims and methods. Being non-commercial in character, the association has no interest in steering travelers to the most expensive routes and hotels, but tries rather to interest young people in making inexpensive tours requiring some physical effort and hardihood. It works by means of books, pamphlets, exhibitions of photographs, lectures, school exhibits, and illustrated tourist guides. Twenty-five tourist stations are maintained in various parts of the country. The income of the association is derived from the sale of its publications and the dues of its members, who in 1916 numbered upward of 60,000. It has an annual budget of about \$70,000.

The yearbook for 1915 devotes much of its space to Uppland, a region rich in historic associations and including the capital, Stockholm, and the chief university town, Upsala, built on the site of the old heathen sacrifices. Besides practical directions for short trips, there are special chapters devoted to the history of Upsala, its prehistoric relics, the famous castles in the neighborhood, the quaint bell-towers so frequently found beside the churches, the arts and crafts of the district, and a sketch of the people.

The yearbook for 1916 gives the place of honor to Småland, a tract lying between the Baltic and the great inland lake, the Vättern. The introductory chapter is signed by no less famous a name than that of Ellen Key, who spent her childhood in Småland. The volume contains, along with much other interesting matter, a description of Karungi, Sweden's gateway to the east, which has sprung into prominence during the war.

HANNA ASTRUP LARSEN.

HARVEY, W. J., AND CHRISTIAN REPPEN. *Denmark and the Danes: A survey of Danish life, institutions, and culture*. 346 pp.; map, ill., index. T. Fisher Unwin, Ltd., London [1915]. 8s. 9×6 .

This volume well fills the promise of its comprehensive title. It is a veritable encyclopedia, showing contemporary Denmark on a background of its history, racial development, and the physical aspects of the country. We find that the achievements of Danish farmers in the last half century are by no means to be accounted for by especially favorable conditions of nature. On the contrary, the land as a whole is not fruitful, and the tillable area is reduced by the immense stretches of boggy heath in Jutland. Along the western coast there are sand dunes extending for two hundred miles and five or six miles wide. There are on an average 156 days of rain and snow in the year, 94 days of fog and mist, and only 1,200 hours of sunshine.

The success of the farmers in the face of adverse conditions the authors attribute to the character of the people, their capacity for hard work and sustained effort, and their readiness to throw aside traditional methods. The Society for the Cultivation of the Heath, with a subsidy from the state, has reduced the unproductive area from 2,200 to 900 square miles. Wise legislation has split up the country into small freeholds, until one half of the area of Denmark is taken up by farms of between 38 and 150 acres. To enable families to live on such small acreage, the Government has encouraged

intensive farming. It lends money to the small holder on easy terms, gives stipends for study abroad, and maintains the Copenhagen High School of Scientific Agriculture with a thorough course extending from two and a half to four years. This is the headquarters of scientific farming in Denmark, from which lecturers and inspectors go out to the farmers, and where experiments bearing on every phase of farming are made.

The scientific precision with which dairying is carried on in Denmark, from the artificially cooled milk-pail to the dustless crane that delivers the cheapest and most wholesome milk in the world to the consumer, would be an object lesson to the slipshod methods of milk distribution in our large cities. The disadvantages of small farms are counteracted by the co-operative societies that give the individual farmer all the benefits of production on a large scale. Collective marketing insures fair prices; the elimination of the middle-man adds to the farmer's profit, and a uniform high grade of product is insured. The first co-operative dairy was opened in Jutland in 1882, and was soon followed by others. Now there are 1,200 such dairies, owning more than a million cows. The immense increase in the finest agricultural products has naturally given great stimulus to the foreign trade of Denmark; butter, cheese, eggs, and meat are exported, while fodder and manufactured products are imported. HANNA ASTRUP LARSEN.

TANNER, V. **Studier öfver Kvartärsystemet i Fennoskandias nordliga delar. III: Om Landisens rörelser och afsmältning i Finska Lappland och angränsande Trakter.** ix and 815 pp.; maps, diagrs., ills., bibliogr. *Bull. de la Commission Geol. de Finlande No. 38.* Helsingfors, 1915.

The region embraced in this report lies entirely north of the Arctic Circle, and the principal map covers parts of Norway and Sweden as well as northern Finland and adjacent parts of Russia to the east. It covers the mainland from about the 17th to the 33d meridian east of Greenwich. The author spent about ten field seasons in this region. The report also embraces the main results of studies by other geologists, some of which had not been published. It presents therefore a comprehensive statement of the existing knowledge of the Quaternary deposits and features of the region. The résumé in French is sufficiently full to give the reader a clear understanding of the contents of the volume.

There is space in this review merely to outline the topics discussed, and to state that the discussion is clear and full. The illustrations also are well calculated to make clear the descriptions.

The first part, pages 12-144, discusses the manner in which the ice spread over the region, as indicated by transport of rock materials, by striae and *roches moutonnées*. The author thinks it probable that the ice extended beyond the land limits and formed shelf ice like that on the border of Antarctica.

The second and longer part deals with the ice recession. It goes fully into the description of moraines and gives several classes, terminal, radial, lateral, and the "Moränbacklandskap." Considerable attention is given to glacial lakes held up by ice dams, and the maps show their distribution, and their relations to the ice and to present drainage. The former extension of marine waters is also discussed.

FRANK LEVERETT.

ÅKERBLOM, F. **Bulletin mensuel de l'Observatoire Météorologique de l'Université d'Upsala.** Vol. 47, 1915, pp. 1-74. Upsala, 1915-16.

ANDERSSON, GUNNAR. **Nya svenska kartverk.** Maps. *Ymer*, Vol. 36, 1916, No. 1, pp. 1-14.

ERKES, HEINRICH. **Neue Beiträge zur Kenntnis Inner-Islands.** Ills. *Mitt. des Vereins für Erdkunde zu Dresden*, Vol. 2, 1914, No. 9, pp. 989-1040. [See the reference to the writer's previous work in Iceland in the March, 1917, *Geogr. Rev.*, p. 213.]

EKMÄN, SVEN. **Die Bodenfauna des Vättern, qualitativ und quantitativ untersucht.** Map, diagrs., ills., bibliogr. *Internat. Revue der gesamten Hydrobiol. und Hydrogr.*, Vol. 7, 1915, No. 2-3, pp. 146-204; No. 4-5, pp. 275-425. [Lake Vättern in southern Sweden.]

GRANLUND, ERIK. **Borlänge: En egenartad svensk stadstyp.** Maps. *Ymer*, Vol. 36, 1916, No. 1, pp. 39-44. [This small town in 60½° N. and 15½° E. constitutes a unique type of city.]

HATT, GUDMUND. **Agervandingen i Gudbrandsdalen.** Diagrs., ills. *Geografisk Tidskrift*, Vol. 23, 1915-16, No. 4, pp. 148-158. [On irrigation in the main transverse valley-trough of Norway.]

JÖNSSON, FINNUR. **Topografiske beskrivelser i Sagaerne og deres betydning.** Maps. *Oversigt over det Kgl. Danske Videnskabernes Selskabs Forhandlinger*, 1915,

No. 6, pp. 525-537. Copenhagen. [On the authenticity of the facts related in the Sagas judged by the topographical description contained in them.]

JUHLIN-DANNFELT, H. **The present state of agriculture in Sweden.** *Monthly Bull. of Agric. Intelligence and Plant Diseases*, Vol. 7, 1916, No. 7, pp. 921-932. Internatl. Inst. of Agric., Rome.

— **Magnetisk Aarbog (Annuaire Magnétique)**, 1913: 8 pp.; 1914: 11 pp. Diags. in each. Publ. fra det Danske Meteorol. Inst., Copenhagen, 1915 and 1916.

— **Statens järnvägar under År 1915: Preliminär redogörelse.** 105 pp.; diags. *Järnvägsstatistiska Meddelanden*, Vol. 4 (Series D), Extrahäfte. Kungl. Järnvägsstyrelsen, Stockholm, 1916.

STÖRMER, CARL. **Preliminary report on the results of the Aurora-Borealis Expedition to Bossekop in the spring of 1913. (Fourth communication.)** Maps, diags., ill. *Terrestr. Magnet. and Atmospher. Electr.*, Vol. 21, 1916, No. 2, pp. 45-56.

— **Sverige, Statistisk Årsbok för, Tredje Årgången, 1916.** x and 365 pp. Kungl. Statistiska Centralbyrån, Stockholm, 1916.

THORODDSEN, T. **Vulkanske udbrud i Vatnajökull paa Island.** *Geografisk Tidsskrift*, Vol. 23, 1915-16, No. 4, pp. 118-132.

WRÅK, WALTER. **Resultatet av floderosionen inom Skandinavien sedan sista interglaciertidens slut.** Diagr., ill. *Ymer*, Vol. 36, 1916, No. 3, pp. 215-267.

AFRICA

SOUTH AFRICA

ALSTON, MADELINE. **From the heart of the veld.** xii and 253 pp. John Lane Company, London, New York, 1916. 5s. 8 x 5.

The author lived with her family on the veld, or grassland, of inner South Africa. She liked the life, finding nothing lonely or dull on a veld farm, for she was keenly interested in many phases of the novel nature around her. There is not a dull page in the book; and it is worth reading, most of all because the author has a touch of the gift that made the descriptions of Olive Schreiner so vivid and true a picture of life on the veld. One diversion from her main theme is excusable, for it shows how much the books she loved best helped to enrich her years in this vast and lofty wilderness. The family took leisurely trips to most parts of South Africa, and the author briefly compares and contrasts regions and towns and tells what each stands for in relation to human well-being.

BEWS, J. W. **An account of the chief types of vegetation in South Africa, with notes on the plant succession.** Diagr., bibliogr. *Journ. of Ecology*, Vol. 4, 1916, No. 3-4, pp. 129-159.

The geographical essentials of this report may be summarized by two quotations (pp. 156-157): "There are few countries that can show more varied types of vegetation than South Africa. There is every stage from desert and open edaphic formations, through every gradation of open, semi-open and closed steppe, through great variety of sclerophyllous and other scrub to a mesophytic type of evergreen bush, while along the coast there are psammophilous bush and mangrove types. The succession is not always toward the mesophytic, as is shown by the presence of succulent scrub in the dry river valleys. Tree veld of various kinds—an intermediate type between grassland and forest—covers enormous areas and may represent an early stage of succession to a xerophytic type of bush, which retains its present character through the influence of grass fires.

"One striking feature of the vegetation as a whole is the rarity of formations or associations dominated by a single species. The mallee and heath formations, scrub of various kinds, most of the bush, much of the veld and tree veld, the Karroo and psammophilous bush of the coast, are all made up of a conglomeration of species. In the closer formation masses and clumps or tussocks, consisting of half a dozen species with their branches completely intertwined and commingled, are a common feature. There are, however, a few exceptions to this."

"In many cases, the fact that no single species has been able to assume dominance may be considered to point to a lack of stability in the environmental conditions, but it is doubtful if this is sufficient to explain all the facts. *Leucosidea* scrub is an unstable type and yet it is often pure. The wattle tree, *Acacia mollissima*, a native of Australia, large plantations of which are now a feature of the landscape in Natal, is quite at home and in places, e. g. in the Harding district, is spreading naturally. Among

the wattle, hardly any native species is able to exist. There is no undergrowth of any kind. An introduced species therefore is apparently able to assume complete dominance, while our native species of trees are not. This, however, is not apparent in the case of introduced weeds, with one or two exceptions. The vegetation of South Africa, as a whole, is resistant to invaders."

The paper closes with an interesting figure which shows schematically the relationships between the various types of South African vegetation.

EVELEIGH, WILLIAM. **South-west Africa.** ix and 260 pp.; bibliogr., index. T. Fisher Unwin, Ltd., London [1915]. 5s. 7½ x 5.

A clear and careful summary of leading facts relating to the land, climate, fauna, flora, economic resources, and the white and native population of the country. When the German government acquired a foothold, in 1883, this was believed to be one of the most unpromising parts of Africa. Mr. Eveleigh presents the facts, now well established, showing that the country, on the contrary, is desirable for the variety and extent of its resources and for other natural inducements it offers to white men and women to make homes there. After years of war with the natives, the German colony made much material progress and, best of all, became the home of many contented German farmers. When the European war began, there were 1,625 white children in the country, most of them born there of mothers who had come from Germany to marry Germans who were developing small farms or ranches or had found work in the towns and mining districts. This, as Mr. Eveleigh says, was a healthful sign, showing that conditions were improving and that the life of the people was becoming stable.

The book discusses Southwest Africa simply as a region where a considerable though not dense white population may be healthy and enjoy fair prosperity. Minerals, pastures, and agricultural lands are the three natural sources of wealth. The minerals are first in importance. The diamond fields, near the sea, where gems are dug out of the unconsolidated sands, may not be exhausted for twenty years. How the diamonds got there is not known, but the most favored theory is that of Dr. Wagner, who concludes that the parent rock of the diamonds lies submerged off the present coast. Copper ores bid fair to yield large quantities of the metal for many years. Tin and marble seem likely to become important. The country has great stock-raising possibilities; and Dr. Rohrbach estimates that the grazing lands can carry 3,000,000 cattle and 2,000,000 sheep and goats; but the pasturage is thin, and a stock farm, to give adequate return, should contain at least 20,000 acres.

The book is conservative, scientific, and readable. It is, thus far, the best general description in English of this region. An excellent account of the physical geography appeared in 1916 in P. A. Wagner's "The Geology and Mineral Industry of South-west Africa," reviewed in the August, 1916, *Geogr. Rev.* (Vol. 2, pp. 155-156).

CYRUS C. ADAMS.

— LOURENÇO MARQUES, **A year book of information regarding the town and port of: The Delagoa directory, 1916.** 205 pp.; ill., index. A. W. Bayly & Co., Lourenço Marques, 1916. 2s. 6d. 8½ x 5½.

This port, with the largest and best harbor in Africa, had little part in African trade till the Transvaal railroad system was linked up with it. Portugal since then has given Lourenço Marques due attention. Swamps have been drained to the great improvement of the public health. Commodious government buildings have been erected, and twelve large steamships can tie up at the same time, with every convenience at the docks for handling freight. The Transvaal supplies most of the trade; but while the Transvaal imports about half of its foreign commodities through Lourenço Marques, nearly all its exports are sent to Cape Colony shipping points. The tidal rise and fall is 11 feet at spring tide, which is a slight inconvenience.

CYRUS C. ADAMS.

ALVARES, P. A. **O regime dos prazos da Zambezia.** *Bol. Soc. de Geogr. de Lisboa*, Ser. 34, 1916, No. 4-6, pp. 137-213.

BASCHIN, O. **Die Huibhochfläche in Südwestafrika.** *Die Naturwissenschaften*, Vol. 4, 1916, No. 10, pp. 128-129. [Abstract of two lectures before the Berlin Geographical Society on Feb. 5, 1916.]

BOYES, C. E. **Basutoland: Report for 1915-16.** 17 pp. *Ann. Colonial Repts.* No. 911. London, 1916.

EVANS, M. S. **A survey of the past and present relations of the European and Bantu races in Natal and surrounding territories.** *South African Journ. of Sci.*, Vol. 13, 1916, No. 3, pp. 117-128.

FRIES, R. E. **Vegetationsbilder aus dem Bangweolagebiet (Nordost-Rhodesia).** 20 pp.; ills. *Vegetationsbilder, herausgegeben von G. Karsten und H. Schenck*, Ser. 12, No. 1. Gustav Fischer, Jena, 1914.

HOLLAND, R. S. **Report to the Board of Trade on the trade of the Union of South Africa (and Rhodesia) for the year 1913.** 78 pp. London, 1914. [Trade statistics and analysis are preceded by paragraphs relative to the all-important labor question. The findings of the Economic Commission (of 1913) are quoted, and attention is directed to the particular problems presented by the "Cape colored" man and by the coolie of Natal.]

JACKSON, G. F. T. **The Hex River Mountains, Cape Colony.** Ills. *Alpine Journ.*, No. 211, Vol. 30, 1916, pp. 44-47.

JOLLIE, E. (C.). **The back of beyond in Rhodesia.** *United Empire*, Vol. 7, N. S., 1917, No. 12, pp. 769-775. [The little-known Gazaland.]

MACDONELL, —. **Report on the trade and commerce of Lourenço Marques and other Portuguese possessions in East Africa for the year 1914.** 60 pp. *Diplomatic and Consular Repts., Ann. Series*, No. 5558, London, 1916. [See note in the May, 1916, *Review* (Vol. 1, p. 376).]

— **Nyasaland: Report for 1915-16.** 11 pp. *Ann. Colonial Repts.* No. 919. London, 1917.

SUTTON, J. R. **South African coast temperatures.** *Quart. Journ. Roy. Meteorol. Soc.*, No. 178, Vol. 42, 1916, pp. 107-111 (discussion, p. 111). [The paper calls attention to the abnormal lagging of the winter maximum at the stations of East London and Cape St. Francis. An important influence is attributed to the churning of the coast waters by the characteristic and violent spring gales experienced off the southeast coast.]

MATHEMATICAL GEOGRAPHY

CARTOGRAPHY

HUTCHINSON, H. D. **Military sketching made easy and military maps explained.** Seventh edition. Revised and brought up to date by R. F. Pearson. xvi and 230 pp.; maps, diags. Gale & Polden, Ltd., London, 1916. 4s. 7 x 5.

In the seventh edition of this popular army manual, the work has been completely revised to agree with the latest official textbooks on the subject. A chapter has been added on the subject of military freehand drawing. Though all technicalities have been avoided, the treatment is very complete and includes all points with which a line officer should be familiar. An excellent feature is the collection of numerous good examples and problems to explain every phase of the subject. Colored plates and numerous diagrams fully illustrate the book without preventing it from being sold at a very reasonable price.

JAMES GORDON STEESE.

LEGGE, R. F. **Military sketching and map reading for non-coms. & men.** viii and 78 pp.; maps, diags. Gale & Polden, Ltd., London, 1916. 1s. 6d. 7 x 5.

The present war has brought out a number of books to supply the pressing needs of the new levies. In this work the author has endeavored to include "everything that a noncommissioned officer could possibly be expected to know about military sketching or map reading, and to arrange it all so simply that a man with no previous knowledge of either subject could readily understand those things dealt with." The treatment, though elementary, is excellent, especially those sections devoted to scales and to descriptions of instruments used in sketching. Though inexpensively produced and sold at an absurdly low price, the book is adequately illustrated, many plates being in color.

JAMES GORDON STEESE.

MOCKLER-FERRYMAN, A. E. **Military sketching, map reading, and reconnaissance.** Second edition. xi and 202 pp.; maps, diags., ills., glossary, index. Edward Stanford, London, 1911. 5s. 7½ x 5.

Colonel Mockler-Ferryman's textbook is intended for the beginner, but he hopes "that it contains sufficient information to enable any officer to pass the required examinations up to the rank of Lieutenant Colonel." It is an excellent work, complete and progressive in treatment, and should be of great value in training the recent levies in military topography.

The first twelve chapters are devoted to sketching, two chapters to map reading, two to reconnaissance, and the final chapter to marching on compass bearings. In the

four appendices are found reconnaissance notes and memoranda, a description of useful instruments and sketching accessories, and practical hints on examination questions. The typography is excellent. On the cover is a scale of inches.

To pace yards requires considerable effort, especially on uneven ground, and distracts one's attention. Since special pace or time scales must be made for mounted work, it would be better for a sketcher to make a scale of his natural paces and paste or scratch it on his alidade. A piquet location is referred to as 3-4 mile S. by E. of the T in DAINTREE PARK. A reference to a natural feature *on the ground* would be preferable.

JAMES GORDON STEESE.

PEARSON, R. F. **Military panorama drawing in three lessons, and notes on hand sketches, panoramas from maps, maps from panoramas.** 18 pp.; diags. Gale & Polden, Ltd., London, 1914. 1s. 6d. 7 x 5.

An excellent little book giving in six pages sufficient directions for making a satisfactory hasty military panorama sketch. In the following pages are given some notes on hand sketches, panoramas from maps, and maps from panoramas. Illustrations show successive stages in the development of the sketches.

JAMES GORDON STEESE.

EGERER, A. **Die Kartographie auf der Internationalen Ausstellung für Buchgewerbe und Graphik in Leipzig 1914.** *Zeitschr. für Vermessungswesen*, Vol. 43, 1914, No. 27, pp. 681-696. Stuttgart.

JONES, E. L. **Elements of chart making.** 15 pp.; maps, diags., ills., bibliogr. *U. S. Coast and Geodetic Survey Special Publ. No. 38.* Washington, D. C., 1916.

NALLINO, C. A. **Un mappamondo arabo disegnato nel 1579 da 'Ali ibn Ahmad al-Sharafî di Sfax.** Map. *Boll. della Reale Soc. Geogr. Italiana*, Vol. 5, 1916, No. 9, pp. 721-736.

PARTSCH, J. **Die Internationale Weltkarte in 1:100,000: Ein Rückblick—ein Ausblick.** *Mitt. der Gesell. für Erdkunde zu Leipzig*, 1913, pp. 80-98.

WHITEHOUSE, W. E. **Military map reading classes.** *Geogr. Teacher*, No. 43, Vol. 8, 1915, Part 3, pp. 184-188.

HUMAN GEOGRAPHY

ANTHROPOGEOGRAPHY

BRISTOL, L. M. **Social adaptation: A study in the development of the doctrine of adaptation as a theory of social progress.** With a preface by T. N. Carver. xii and 356 pp.; diags., bibliogr., index. (*Harvard Economic Studies*, Vol. 14.) Harvard University Press, Cambridge, 1915. \$2.00. 9 x 6.

Strictly speaking, this book allots but a minimal space to anthropogeography: Ratzel and his American interpreter, Miss Semple, receive, in fact, only four pages. Buckle has six and Ripley five. These names are bracketed with that of Karl Marx under the caption "The Environmental School of Sociologists." This whole section of the volume, dedicated to "Passive Physical and Physio-social Adaptation," including "Biological Evolution" and "Neo-Darwinian Sociologists," occupies but sixty pages. These details are cited to indicate what the geographers and other natural scientists can expect to find accredited to them in this attempt to list up contributions to the understanding of social adaptation. Perhaps it would be logical to attach to the account of natural science also the chapters on the "Development of the Concept of Society as an Organism," where Schäffle, Le Bon, Durkheim, and others are cited, and that upon "The Anthropological Sociologists," including Sumner, Boas, and Westernmark. However, the section under which those names appear is entitled "Passive Spiritual Adaptation," which would seem to remove it safely from the confines of natural science.

It can be seen that the author of this study, and his adviser, do not lean very strongly toward the school of the anthropogeographers. The tendency is rather to emphasize the psychological aspects of adaptation. And so we pass on from "Passive Physical and Physio-social Adaptation" to "Passive Spiritual Adaptation," then to "Active Material Adaptation" (Ward, Patten, Carver), and finally to "Active Spiritual Adaptation" (Novicow, Carlyle, William James, Ross, Baldwin). In the end we arrive at the author's conviction that "social-personalism" is the true "social philosophy"; "we believe that the Kingdom of God will come by the spread, through reflective imitation, of the achievements of the groups setting the best example of social organization and collective welfare, and that the 'gospel of social-personalism' working by purposeful idealization, innovation, imitation, and exemplification will demonstrate its superiority over any form of deterministic monism or the gospel of the productive life."

Perhaps the general scope of this book has now been indicated. It is really a collection of the theories of many writers with respect to the concept of social adaptation, topped off by the author's theory. As such perhaps there should be no caviling as to the proportion of attention assigned to this and that theory, provided that the essentials of each are represented. And it cannot be denied that the author has produced a really remarkable set of summaries. He seems to have seized upon the central points of the several theories and to have been very happy in his exposition. He is not seldom, indeed, clearer than his originals. For these qualities and this service he is to be highly commended; it is, I think, impossible to match this volume as a brief but adequate summary of thought along this line of social evolution. Often the big idea of a big man needs less space for its presentation than the smaller and more whimsically involved conception of the theorist of lesser caliber. The reader who is able to lay his own stresses can get only good out of Professor Bristol's exposition.

However, it cannot be denied that the object of the book under review is heuristic as well as expository, and the reviewer is bound to express himself as to this matter of stresses. However fairly and dispassionately the author may present the several viewpoints, he yet works toward one of his own, and it is permissible to infer as to how he gets there. This brings me back to my opening statements as to the paucity of matter cited with reference to natural science and especially anthropogeography. It is plain enough that the author's sympathies do not go out very far in this direction. Here he is a reporter rather than an understanding adherent. He warmly commends Miss Semple's book, it is true—it "indicates a breadth of vision, a wealth of material gleaned from numerous authorities, and a general grasp of all the factors that enter into social life and social progress, that is highly satisfactory"—but he does not use the factor of environmental influence thereafter. He works over into his "purposeful idealization, innovation, imitation, and exemplification"—into the "gospel of social-personalism." If the factor of environmental influence is here, it is pretty well submerged. (I confine myself to the treatment of this factor, though there are others that are merely catalogued, labeled, and left.)

Now there is no other such safety-spot for the student of human society, amidst the confusions of his subject, as the one built up on a knowledge and appreciation of physical realities. The earth is not all bed-rock or hard-pan, and it would be a miserable place if it were; but it is necessary to get down to something that will not give at every strain, if much is going to be done up above. The skyey structure of social-personalism does not seem to rest upon immovables; you miss the connection with the lowlier, but solid things. The believer in the perennial quality of physical influences becomes uneasy when he sees them perfunctorily noted and not recurred to. It is not because he thinks his own speciality is the only thing worth while, or that geographic controls will explain everything. It is mainly because he knows that theories which do not take much account of factors whose influence is demonstrable by concrete tests and actual records are likely to be evanescent as well as fantastic.

The general form and attractiveness of the book leave nothing to be desired.

A. G. KELLER.

HATT, GUDMUND. **Moccasins and their relation to Arctic footwear.** *Diagrs., ill. Memoirs of the Amer. Anthropol. Assoc.*, Vol. 3, 1916, No. 3, pp. 151-250.

HERBERTSON, A. J. **Regional environment, heredity, and consciousness.** *Geogr. Teacher*, No. 43, Vol. 8, 1915, Part 3, pp. 147-153. [Posthumous essay representing possibly the climax of the author's philosophy of geography.]

HOLDICH, T. H. **Geographical problems in boundary making.** *Maps. Geogr. Journ.*, Vol. 47, 1916, No. 6, pp. 421-440.

HOMBURG, FREDERICK. **Names of cities.** *Journ. of Geogr.*, Vol. 15, 1916-17, No. 1, pp. 17-23.

HYDE, W. W. **The ancient appreciation of mountain scenery.** Reprint from the *Classical Journ.*, Vol. 11, 1915, No. 2, pp. 70-84. [Abstracted in the July, 1916, *Review*, pp. 64-65.]

MONDAINI, GENNARO. **Un tentativo di sistemazione della scienza coloniale (La colonistica del De Lannoy).** *Riv. Coloniale*, Vol. 11, 1916, No. 12, pp. 705-721.

SLOSSON, P. W. **The storm belt of civilization.** *Maps. The Independent*, 1916, Sept. 11, p. 380. [Review of Ellsworth Huntington's "Civilization and Climate"; see *Geogr. Rev.*, Vol. 3, 1917, p. 252.]

TEN KATE, HERMAN. **Psychologie en ethnologie in de koloniale politiek.** *De Indische Gids*, Vol. 38, 1916, No. 6, pp. 701-749; No. 7, pp. 861-909.

TROTTER, SPENCER. **The fundamental nature of population.** *Scientific Monthly*, Vol. 4, 1917, No. 3, pp. 263-273.

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THE COPPER ESKIMOS*

By DIAMOND JENNESS

Ethnologist, Canadian Arctic Expedition

The so-called Central or Copper Eskimos live in part on the northern fringe of the mainland coast of North America in the Coronation Gulf region and in part on the great land mass known as Victoria Island, which lies directly north. The region over which they migrate extends from Stapylton Bay on the west to and beyond Kent Peninsula on the east (Fig. 1). During the two years from September, 1914, to July, 1916, I lived in their winter settlements, which are distributed all the way from Dolphin and Union Strait to Bathurst Inlet, and in that time I spent seven months—April to November, 1915—wandering alone with them in the southwestern part of Victoria Island. The following account of their life and its relation to their Arctic home is based on my experiences during that time and on information obtained from other members of the Canadian Arctic Expedition.

It will help our understanding of their customs, and particularly their migrations and trade, if we glance for a moment at their geographical distribution. They live in five groups, each of which again has its minor subdivisions, as follows:

(1) Those who winter in Prince Albert Sound and in the vicinity of Minto Inlet on Victoria Island. The former are known as Kanghiryuarmiut and have been estimated by Stefansson to number about two hundred;¹ the latter, Kanghiryuatjagmiut, are stated by the same authority to consist of three families only, and number therefore about fourteen or fifteen. In the winter of 1915-16, however, many Kanghiryuarmiut joined their northern neighbors, so that the two settlements were about evenly divided.

* In 1916 Mr. Jenness made a report to the Canadian government on his work among the Copper Eskimos. The report is dated July 18, *H. M. S. Alaska*, Young Point, North West Territories. It is published here for the first time, and with appropriate alterations, by courtesy of the Commissioner of the North-West Mounted Police at Regina.

¹ For an account of the discovery of this tribe see V. Stefansson's "My Life with the Eskimo," New York, 1913, p. 279.

in winter at the west end of Coronation Gulf and are composed of Pallirmiut from Rae River, Kogluktomiut from the Coppermine, Asiagmiut from the country between the Coppermine and Tree Rivers, and Nagyuktomiut from the opposite side of the strait. They are often called collectively Walliarmiut, from Walliak, the Eskimo name of Richardson River. Their number, like that of all the groups in this region, varies from year to year but may be stated approximately at one hundred.

(4) East Coronation Gulf Eskimos, comprising Tree River natives (Pingangnaktomiut), Nenitagmiut from the country behind Gray Bay, Kilusiktomiut from Arctic Sound, Umingmaktomiut from the east side of Bathurst Inlet, and Kiglingilmiut from the coast of Victoria Island opposite. A few families live inland south of Bathurst Inlet, in the country called Saningaiyok, but they rarely come to the coast. The more western natives often refer to this eastern group as Kivalirmiut, or the eastern people. Their number is approximately one hundred and fifty.

(5) Dease Strait natives, consisting of Asiagmiut³ from the country east of Kent Peninsula, and Ekalluktomiut from the southeastern extremity of Victoria Island. Very little is known about these Eskimos, but the natives of the eastern part of Coronation Gulf, with whom they have regular communication, estimate them at about one hundred.

These groups are permanent, but the families who compose them continually change from one to another, so that the location of a man at any particular time is uncertain. As a rule it is to a neighboring group that he attaches himself for a season or two, but occasionally to one more remote. Contact takes place between the different groups mainly in the spring, and it is then that their composition undergoes a change. There is brisk trading, too, in pots, lamps, weapons, skins, and other household furnishings. The desire to trade often impels them to make extensive journeys. From eastern Coronation Gulf they connect with the Nechillingmiut Eskimos of Back's River⁴ and with the natives on the Arkkillinirk, or Thelon River,⁵ both of whom have direct relations with white traders. Since 1911 the Coronation Gulf natives have visited Great Bear Lake each year to trade with whites and Indians. Half a century ago the Dolphin and Union Strait Eskimos used to meet others that went eastward one hundred to one hundred and fifty miles from Cape Parry and Cape Bathurst to the vicinity of Wise Point, but since white men have established themselves in the Mackenzie Delta and since whaling ships have paid regular visits to Herschel and Baillie Islands, respectively at its western and its eastern portal, broadly speaking, the Copper Eskimos have lost touch with their western neighbors. In 1905, however, C. Klongenberg in the *Olga*, and in 1907 C. Mogg, in another vessel of the same name, wintered on the south-

³ Just off the right margin of the map in 102° W.

⁴ Flows east-northeastward some 150 to 200 miles inland from the longitude of Bathurst Inlet to that of Elliot Bay (96° W.), where it debouches.

⁵ Some 75 to 100 miles south of Back's River.



FIG. 2.—Spring camp of the Copper Eskimos at Bernard Harbor, Dolphin and Union Strait, June, 1916. Women pegging out deerskins to dry. (Figs. 2-11 are from photos by the author, published by courtesy of the Geological Survey of Canada.)



FIG. 3—Eskimos spearing salmon as they migrate up the streams. June, 1916.

west coast of Victoria Island; both had western Eskimos among their crews and both met the local natives for a short period. Stefansson met them in 1910 and again in company with Dr. R. M. Anderson in 1911, on both occasions accompanied by western Eskimos. In 1910, J. Bernard entered the country and spent a winter; in 1912 he returned and spent two additional winters, having with him an Eskimo family from Baillie Island. From 1914 to 1916 the Canadian Arctic Expedition was in uninterrupted contact with the same natives, while the northern party of the same expedition met the Eskimos of Prince Albert Sound and Minto Inlet. The Anglican Church has sent missionaries into the country, who have now probably established themselves in Dolphin and Union Strait. Traders and western Eskimos are reported to be following in their wake, so that the Copper Eskimos will again have constant relations with the west, and with the whites as well as with the old trading groups they have been accustomed to meet in years past.

The language of the Copper Eskimos, so far as we now know, is practically uniform. Its nearest relations seem to be with the Mackenzie dialect rather than with that of Hudson Bay, but natives from either place should make satisfactory interpreters. A Mackenzie native would probably get on better with the western Copper Eskimos and a Hudson Bay native with the eastern, but neither would have any serious difficulty anywhere.

Established authority among the Copper Eskimos is unknown. By virtue of their personal dignity, their force of character, skill in hunting, or reputation for magical power, certain men are more influential than others but possess no constituted authority over a group or tribe. The only law is custom, handed down from generation to generation; it alone upholds the structure of society, maintains the taboos, and regulates the relation of family to family and of man to man. Its sanction is religion, and violation of custom is punished, through spiritual powers, by sickness and death, or ill-success in hunting and fishing. The magic of the shamans is, for the most part, devoted to neutralizing or securing the active support of the innumerable spirits that are believed to control the phenomena of nature and the supply of game. Misfortune and death are occasionally ascribed to evil magic, but any man suspected of sorcery is liable to sudden murderous attack from his fellow-tribesmen.

Speaking generally, all food is shared in common, but weapons, tools, and household furnishings are private property. The greatest check on theft is the extreme intimacy of social relations, everyone being aware of what is said, done, or owned by all the rest. Nevertheless a little pilfering does occur, even among themselves; and, in the absence of any established authority, the victim's only redress is by an appeal to physical force, which, with a people whose emotions, like those of children, have not come under the control of a developed temperament, frequently means murder. The



FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.

FIG. 4—A Coronation Gulf Eskimo woman named Paylik, wife of the man shown in Figure 5. April, 1916.

FIG. 5—A Coronation Gulf Eskimo man named Aitauk. Originally he lived at Asiak, east of Kent Peninsula. April, 1916.

FIG. 6—Boy bringing in fuel, consisting of *havyak*, the dry leaves of the *Dryas octopetala*. South-western Victoria Island. July, 1914.

FIG. 7—Tokalluak, a Coronation Gulf Eskimo man. June, 1916.



FIG. 8.



FIG. 9.

FIG. 8—Eskimo settlement of snow huts in the Duke of York Archipelago, Coronation Gulf, March, 1915.
FIG. 9—Copper Eskimos migrating, April, 1915.

most trifling incident may lead to this result. In 1914 a man stabbed another merely to prove that the knife his victim ridiculed was a good one. The murderer in turn is sometimes slain by the kinsmen of his victim and a vendetta is established, but in most cases this outcome is avoided by his flight to another district, when his deed, after the lapse of a few years, passes into oblivion.

Family organization is, in its general features, very similar to our own. Interchange of wives, however, is common, polygamy frequent, and polyandry not unknown. Girls occasionally marry before they attain the age of puberty, but rarely have children before the age of sixteen or seventeen years. The death-rate is high and the mortality among children especially heavy. Infanticide is frequent; four cases occurred in Dolphin and Union Strait in the winter of 1915-16. One of twins is always killed; the girl, if the sexes are different. Usually the child is suffocated before it is exposed. On the other hand, abortion is unknown. The chief reason for infanticide seems to be that the bringing up of a child entails severe hardship on the mother; not only must she nurse it for several years until it is able to endure the strong meat and fish diet which constitutes the only food, but must carry it everywhere on her back, in addition to a heavy pack, through all their migratory summer life. The child is spared, however, if someone can be found to adopt it, and adoption is frequent. The aged and infirm are not abandoned, as is the case among some Eskimo tribes, but receive the utmost kindness and consideration.

The food supply is practically limited to seals, fish, and caribou. Polar bears, brown bears, musk-oxen, squirrels, and one or two minor animals supplement these articles a little in some places, but never become staples. Seal skins and caribou skins are indispensable for clothing and tents, and seal blubber for fuel and light. The natives take kindly to the white man's food, but only as a luxury. Sealing is prosecuted in winter, when the seals are harpooned through their breathing holes in the ice. At this season the Eskimos are gathered in large settlements off the coast. In spring they migrate to the land, scattering into small bands to fish in the streams and lakes and hunt the caribou which are then making their way northwards. For fishing spears and lines are used, usually with barbless hooks; salmon are trapped in stone weirs and speared as they migrate up the streams to the lakes. Caribou are shot with the bow and arrow, or speared from kayaks when driven into lakes. Recently a number of Winchester rifles have been introduced, mostly of 30-30 and .44 caliber. In consequence more caribou are shot than formerly, and the natives are learning to shoot seals on the surface of the ice in spring. Rifles may in years to come seriously reduce the number of caribou in the country, and more valuable than they would be the introduction of fish-nets, for almost every lake teems with salmon and trout, and the salmon annually migrate in large numbers up most of the rivers and creeks. The possession of umiaks, too, if the art of



FIG. 10.



FIG. 11.

FIG. 10—Jiggling for trout through six feet of ice in the spring (May, 1915). Colville Hills, southwestern Victoria Island.

FIG. 11—Building a snow hut, Okauyarvik Creek, southwestern Victoria Island, October, 1915.

making them were learned from the western natives, would greatly assist in the setting of nets as well as in the shooting of seals in the open sea.

Since the visit of J. Bernard, the Eskimos are devoting considerable time to the trapping of foxes. These are probably less numerous than farther west, but still there are enough to make the industry profitable. Traps are in great demand on this account. Every kind of cloth, too, is eagerly sought after. Woolen clothing would be very serviceable during the greater part of the year and cloth tents invaluable in summer; but woolen and cotton garments of any description are likely to introduce pulmonary troubles among a people ignorant of their proper use. At present these people are very healthy and without any serious ailments. The population appears to be about stationary, owing to a low birth-rate and a high death-rate, the result of the hardships of life in the Arctic. But if ever the diseases which have swept through the western Eskimos find their way into this country, more especially measles, tuberculosis, and venereal diseases, half the population would probably be swept away within a decade or two. The two latter diseases, if once introduced, would be ineradicable; they would be handed down from one generation to the next, as in the Mackenzie Delta at the present day. Possibly their introduction is inevitable, but since Herschel Island is the chief portal leading into the country at the present time, there would seem to be some prospect of successfully keeping them out if no one, white or native, were allowed to sail from that port eastward to Coronation Gulf without a medical certificate from the medical officer resident in the Delta; anyone found in the country of the Copper Eskimos without such a certificate could be made liable to immediate deportation.

There is the further question as to what use could be made of the Copper Eskimos in the future development of the country. At the present time the only asset which the country possesses is its fur. These Eskimos should be as successful trappers as any in the North, once they have learned the value of the different kinds and qualities of fur. It is not improbable that the copper deposits in the region may eventually prove of great value, but little can be expected from a purely hunting people in the way of labor for mines. Nevertheless it might be possible to utilize them in other ways, as in the handling of freight and in transport generally.

THE PROPOSED CONNECTION OF THE RUSSIAN AND INDIAN RAILWAY SYSTEMS*

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The plan to connect the railway systems of Russia with those of British India is one that has appealed strongly to the imagination, on account of the commercial advantages that would be gained and the immense saving of time that would be made in traveling between western Europe and India, the richest asset of the British Empire. Hitherto, however, there have been objections on the part of the British Government, which preferred that India should be kept separate from the Russian Empire and the other nations of Europe that might make use of such through railway system for purposes of military invasion. Now, however, the new entente and friendship with Russia may remove political obstacles that stand in the way of connecting the Indian and Russian railway systems.

There has been no railway progress in any part of the Russian Empire so rapid during the past year as the extension of the Bokhara Railway south to the Oxus River, also known as the Amu-Daria, and eastward along the north bank of this river, which forms the boundary between Russian Turkestan and Afghanistan, to the present terminus at Termez (Fig. 2). This is only about 550 miles from Peshawar, on the Indian side of the famous Khyber Pass, by which Alexander the Great invaded India and which has subsequently been always considered, both in a military and commercial sense, as the gateway to that country. A few more months of construction of the Bokhara Railway eastward to Sarai, above the junction of the Kundus and Oxus Rivers, the immediate new goal of this system, will leave a gap of only about 400 miles between the railway system of the Russian Empire and that of British India. Whether or not the system would be extended through this remaining gap will depend on the attitude of the British Government and on the consummation of some arrangement with the Amir of Afghanistan for the laying down of such a line through the north-eastern corner of His Majesty's hermit country. It is believed that the extension through Afghanistan could very likely be carried out by a separate

* See also the writer's report on "Railway Development in Russian Central Asia," *Commerce Repts.*, April 9, 1917, pp. 103-109, and the passages devoted to the railways and trade routes of India (pp. 73-80), Baluchistan (pp. 475-477), and Afghanistan (pp. 541-544) in the writer's "British India," *Spec. Consular Rept. No. 72*, Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, 1915 (reviewed below under "Geographical Publications").—EDIT. NOTE.

company controlled by Russian and British capitalists, with the Amir himself receiving a large proportion of the stock.

The construction of railways in Russian Turkestan has been steadily proceeding for some years past. First the Central Asiatic Railway, from Krasnovodsk on the east coast of the Caspian Sea to Tashkent in Turkestan, was constructed, with a branch to Kushka, only about 100 miles from Herat in Afghanistan. Then, in the year 1905, Tashkent was connected at Orenburg in southeastern Russia near the Urals with the railway system of European Russia. Finally, dating from July, 1915, the Bokhara Railway, starting from the station Kagan, near the city of Bokhara, on the Central Asiatic Railway, has been extended southward to the Oxus River opposite Afghanistan, and eastward to Termez, the present terminus.

In order to make the last link in the connection of the Russian and Indian railway systems, it will be necessary to cross from the basin of the Oxus to the basin of the Indus; between these two basins the mountain range of the Hindu-Kush presents a barrier which would require considerable engineering skill to overcome. The word "Hindu-Kush" means "Dead Hindu." This name has been given to the range from one of its passes, on which an entire tribe of Hindus perished in an attempt to descend into Turkestan. This mountain range of eternal snows has an extent of 400 miles, with but two passes lower than 12,000 feet; Khawak, 11,640 feet; and Bamian, 11,770 feet. Several of the passes reach an altitude of 19,000 feet, and certain peaks attain 24,000 feet. The adjoining region of the Pamir is indeed often appropriately referred to as the "Roof of the World." Three of the largest empires of the world, the Russian, the British Indian, and the Chinese, as well as the very secluded and comparatively unknown nation of Afghanistan, meet near this point.

The engineering problem of constructing a railway through the Hindu-Kush Mountains from Turkestan to India, will, in the opinion of Russian engineers who have made surveys over this part of the route, find a comparatively easy solution by the boring of a tunnel under the divide separating the headwaters of the Kundus River, flowing towards the Oxus River and Turkestan, from the headwaters of the Kabul River, flowing eastward to the Indus, which drains all of northwestern India. Such a tunnel would, it is estimated, be about 13 miles long, and require excavating through granite rock. Except for the 13 miles of tunnel, the railway construction would be comparatively easy, as it would follow the valley of the Kundus on one side of the divide and the valley of the Kabul on the other side. The average cost per mile of the railway, including the tunnel construction, would, it is estimated, be about \$100,000; that is, from the mouth of the Kundus to Peshawar in India, a distance of about 400 miles, the total cost would be about \$40,000,000.

In the event of the construction of this railway through the Hindu-Kush the distance between western Europe, starting from the Hook of Holland,

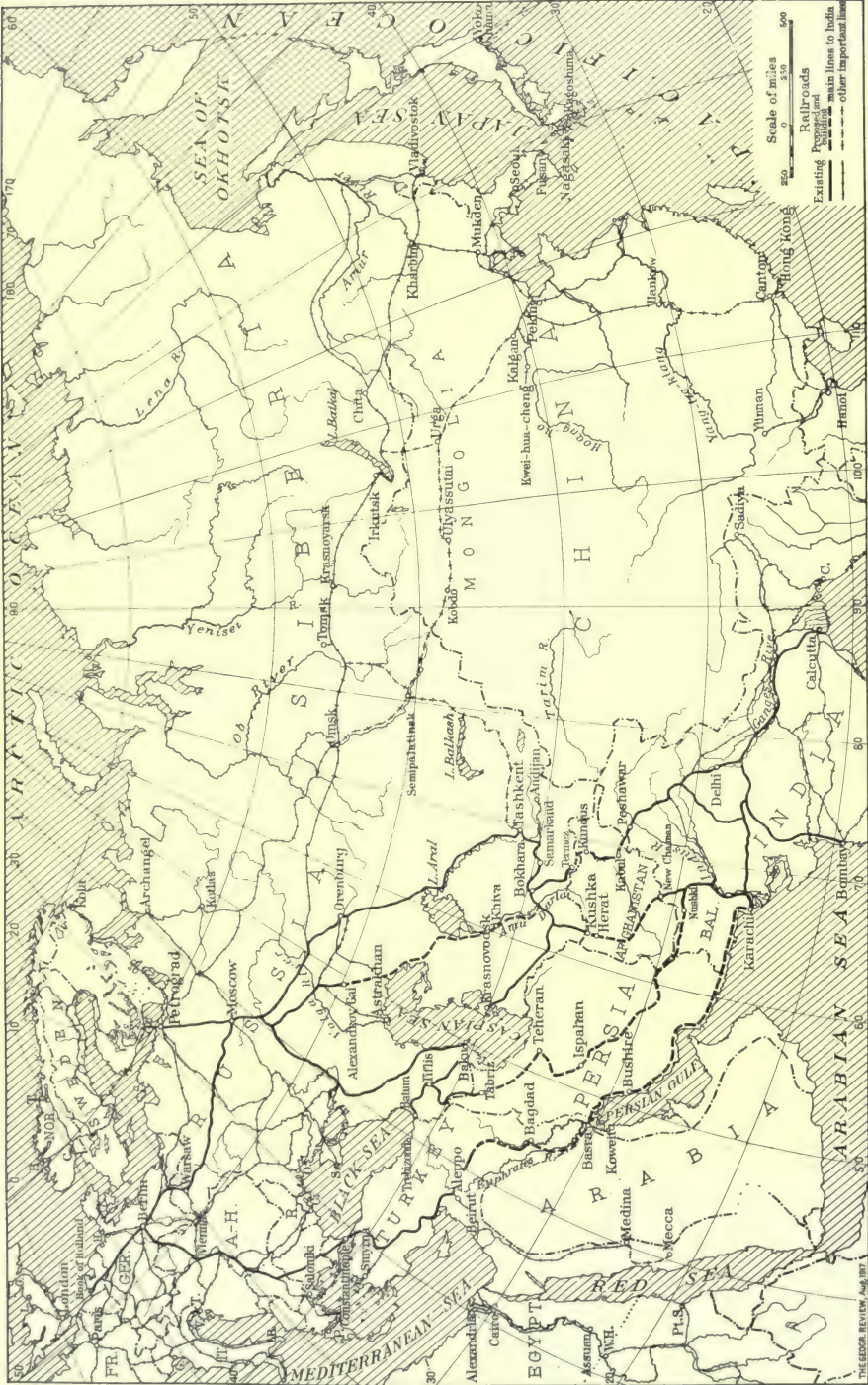


FIG. 1.—Outline map of Eurasia showing the proposed connections between the railway systems of Europe and of India, together with the main lines of eastern Asia. Scale, 1:57,000,000.

reached by fast steamer from England, to the Indian capital at Delhi, would be as follows (see Fig. 1) :

Hook of Holland-Berlin-Warsaw-Moscow.....	1,836 miles
Moscow-Orenburg-Tashkent	2,082 "
Tashkent-Kagan-Mouth of Kundus River.....	750 "
Mouth of Kundus River-Peshawar.....	400 "
Peshawar-Delhi	627 "
Total (in English miles).....	5,695 miles

It may be mentioned that a new railway into Russian Turkestan is now under consideration, via Alexandrov Gai in southeastern Russia and skirting the northeastern shore of the Caspian Sea to Khiva and Bokhara. This railway, if constructed, would make a saving in distance of over 800 miles in the proposed route between Russia and India via the Hindu-Kush.

The Bokhara Railway is owned by Russian capitalists, who have enjoyed special support from the Russian Government and from the Emir of Bokhara, through whose territories the railway has thus far been chiefly operated. It is understood that the Emir of Bokhara has received a bonus of one-third the entire stock of the railway system, but in return he has not only provided the right of way but has also given to the system large tracts of land which would require only a comparatively small expenditure for irrigation from the Oxus River to become one of the finest cotton-growing regions in the world. Interests in control of the Bokhara Railway are giving their attention not only to railway building but also to the development of the country by irrigation and the establishment of industries along the route. Not only do they desire a connection with British India, but they are also already making surveys for possible extension northeast toward the rich gold-mining districts of Mongolia, and for possible connection with the Trans-Siberian Railway at some point in central Siberia.

The great commercial advantages which would result from a connection of the railways of British India with those of Europe must be readily apparent. Although the Indian railway systems are completely isolated from those of other countries, yet they make an average net annual profit of about 7 per cent on their capital. Altogether they have an extent of about 35,000 miles, and much new railway building is planned for the future. If these railways were united with those of Europe, they might take care of an immense through traffic which now of necessity goes by sea via the Suez Canal. Furthermore there should be a great trade developed between Russia and India; for instance, Russia is an immense consumer and India is an immense producer of tea.

The great progress of Russian Turkestan in cotton-growing has excited special attention during the present war, for Russia, owing to the difficulties of securing sufficient cotton from America, through the closing of Baltic Sea ports and the Dardanelles, has been relying more and more on the production in Turkestan, which is increasing heavily each year. Experts in the

Russian cotton trade believe that within ten years Turkestan will produce all the cotton Russia needs, so that no more need be imported from America. There is an extensive movement now for the construction of mills for making cottonseed oil; and it is probable that many textile mills will be erected within the near future, so that Central Asia can produce its own piece goods. In India a beginning has been made in the use of cottonseed oil as a substitute for *ghee*, the native liquified butter which is the chief fat food of millions of her people. It is probable that the immense amount of cottonseed oil which might be produced in Turkestan could be marketed to advantage not only locally but also in British India, if there were railway connections. The proposed railway connection via the Hindu-Kush would also tap Afghanistan, which is a great sheep and fruit country and a large consumer of cotton piece goods, hardware, etc. At present the entire foreign business of Afghanistan goes by caravan routes, the most important via the Khyber Pass. The heavy cost of transportation has so far made the trade of Afghanistan comparatively limited.

A railway connection between India and Europe, say through the Hindu-Kush, would make possible a fast mail service between London and Delhi in six days instead of seventeen days, as at present via the Suez Canal. The cost of the passenger trip by railroad to India would probably be only about half as great as by the present roundabout steamship service. To reduce the time of travel between England and India to one-third of what it is now would prove of incalculable advantage in many ways, and this result would be achieved by the completion of such connections as have been described above.

There is at present in Russia a great awakening to the necessity of expansion in the country's railway facilities, not only to remedy military weaknesses as shown by the war, but also to take advantage of the immense commercial resources of the vast areas of her territory, which, if opened up by adequate railway systems, would experience marvelous development. Not only in Russian Turkestan, but in Persia and Mongolia, important plans have been formed for railway construction to extend the commercial outposts of the Russian Empire.

In addition to the route between Turkestan and India through the Hindu-Kush Mountains, there are also other possible routes to connect India with Europe: (1) by way of Turkey, Persia, and Baluchistan; (2) by way of the Caucasus district of Russia, Persia, and Baluchistan; and (3) by way of Afghanistan, by a line running from Kushka to Herat and then on to Kandahar, only about 80 miles distant from New Chaman in Baluchistan, which is the terminus in Baluchistan of the British Indian railway system.

Until the outbreak of the present war, the two routes by way of Persia had been looked on by the British authorities with more favor than the two possible routes through Russian Turkestan. Of the two Trans-Persian

routes, the first might join the Bagdad Railway from Constantinople at Bagdad, and follow the Euphrates River south to the Persian Gulf at Basra, thence eastward through Bushire and along the southern coast of



FIG. 2—Outline map showing in greater detail the proposed connections between the Russian and the Indian railway systems through Afghanistan. Scale, 1:10,000,000.

Baluchistan to Karachi, the great grain and cotton exporting port near the mouth of the Indus in northwestern India. The second system might extend from Tiflis in Trans-Caucasia, through Tabriz, Kazvin, Teheran, and Ispahan in Persia to Nushki in Baluchistan, where it would join the British Indian railways. Any proposed connection with the Bagdad Railway

would be dependent upon the outcome of the present war, but even if the present war is entirely successful from the standpoint of the Allies, nevertheless there might, from a British standpoint, be a doubt as to the advisability of making a railway connection which might be of more benefit to Germany than to England. There might, on the other hand, be a disposition to encourage construction which would link the Indian with the Russian system by way of the Caucasus railway. It may be mentioned in this connection that a Russian railway from the Araxes River at the frontier of Trans-Caucasia to Tabriz in northwestern Persia was completed¹ in March, 1916, a distance of about 150 miles. The writer was a passenger on the first train that entered the city of Tabriz. There was great excitement in that city when the train arrived, the locomotives being gaily decorated with Russian and Persian flags. This is the first railway in Persia. It is of the same gauge as the Russian railways, so that there is no reason why trains cannot now be run all the way from Petrograd to Tabriz. At present the line is used chiefly for military purposes, but later it will be used for commerce. This line may eventually be pushed on to Teheran, and perhaps later follow the line of the Indo-European telegraph system toward the sphere of British influence in southern Persia, and it would then rest with the British Government whether or not the Baluchistan railway should be extended to southern Persia to meet it. Through central and southern Persia, however, and through western Baluchistan, it would be necessary to traverse a vast tract of country of a desert-like character with little opportunity for profitable business except on through freights from India to Europe. There is no doubt, however, that from the Caucasus district, at least as far as Teheran, such a railway, traversing the richest part of Persia, would be of great local commercial importance and make an outlet for a large Persian trade now conducted under circumstances of considerable delay and difficulty. Before the war most of the trade of Tabriz with the outside world was by caravan route via Trebizond in Asia Minor on the Black Sea.

The proposed route across Afghanistan by way of Kushka, Herat, Kandahar, and New Chaman would be only 475 miles in length. New Chaman in Baluchistan is close to the boundary of Afghanistan. This town is the most westerly railway outpost of the Northwestern Railway of British India and was built rather for military than commercial purposes. It belongs to the government of India. There is in New Chaman a supply of railway equipment adequate to the immediate construction of a line as far as Kandahar, in the event of any disturbance of political relations with Afghanistan. Several years ago the writer was in Baluchistan and traveled on the railway to New Chaman. The railway traverses the country inhabited by nomadic tribes previously considered barbarous. Although the

¹ See report by the writer on "Opening of the First Railway in Persia," *Commerce Repts.*, April 28, 1916, pp. 372-373 (abstracted in the *Geogr. Rev.*, Vol. 2, p. 156).—EDIT. NOTE.

line is always guarded by a few troops, yet such protection is becoming less and less necessary, and it has been noteworthy that the railways have had a civilizing effect on the inhabitants, who, instead of pursuing the life of bandits and robbing and often murdering travelers as hitherto, now employ themselves in farming and other peaceful pursuits. A great deal of fruit from Afghanistan, chiefly melons and grapes, is shipped over this railway to the larger cities of British India, but, owing to the difficulty in transportation in Afghanistan, the fruit is often spoiled before it can get to the railway in Baluchistan.

Taking the Hook of Holland and Delhi as end points, the various proposed routes compare as follows as to distance:

via Berlin-Vienna-Constantinople-Bagdad-Basra-Bushire-Karachi	5,745 miles
via Moscow-Baku-Tiflis-Tabriz-Teheran-Ispahan-Nushki	5,550 "
via Moscow-Alexandrov Gai-Khiva-Bokhara-Termez-Kabul-Peshawar	4,918 "
via Moscow-Orenburg-Tashkent-Bokhara-Kushka-Kandahar-New Chaman. .	5,295 "

Besides the fact that the route through the Hindu-Kush appears the shortest, it would be superior to all the others at the present time from a topographical point of view. It would lie between the immense valley of the Ganges and the Indus on the east and low-lying Europe on the west, having only one great ascent, namely through the Hindu-Kush. For the remainder of the distance it would pass along the plains of India and Turkestan and through the level part of Europe. The routes through Persia and through Turkey would meet entirely different conditions. Here it would be necessary to cut through many ranges of hills, a work which would increase not only the first cost of the railway, but also its operating expense, owing to the considerable grades to be overcome. In addition to this, great difficulties would be encountered, both in construction and maintenance, in the desert regions with their ceaselessly drifting sands, a menace to the roadbeds for hundreds of miles. The other route from Delhi, to New Chaman, Kandahar, Herat, and Kushka, would present more difficult positions than the route through the Hindu-Kush. On its course there would be two mountain passes of considerable height, at Herat and at Kushka.

The way through the Hindu-Kush presents also great advantages over other routes with respect to water supply. Along this entire route rivers flow with abundance of water, which not only would meet the needs of the railway but would be a source of energy for hydro-electric stations. Such stations would facilitate the construction of tunnels and provide electrical traction on the hilly part of the route from the junction of the Andarab with the Kundus, as far as the junction of the Gharband with the Pianjsher. Both proposed routes through Persia contrast unfavorably with this as regards available water supply, as they pass through waterless deserts. The northern Persian route would traverse a vast salt desert, while the southern would go through sterile and almost uninhabited country just north of the Persian Gulf. Because of such topographical difficulties

the cost of construction per mile of a Trans-Persian railway would in no way prove less expensive than one through the Hindu-Kush. The northern Trans-Persian railway would probably cost at least \$170,000,000, and the southern probably somewhat more. The Kushka-Herat-Kandahar-New Chaman route would probably cost somewhat less than the route through the Hindu-Kush but might have offsetting disadvantages, owing to the great fanatical opposition of the Afghans to the presence of Europeans. In this country it is even a capital offense to embrace the Christian religion.

It is doubtful if the British Government will in the future feel the necessity of keeping Afghanistan undeveloped and uncivilized, merely for the purpose of providing a buffer state between Russia and India. With the exception of Tibet, Afghanistan is at present the least known country in the world and is a barrier to commercial intercourse between the world's two greatest empires. In the same way that the new conditions arising from the war have little by little removed the special political objections to a tunnel under the English Channel between England and France, so also political opposition to connecting the British and Russian railway systems seems likely to disappear. From a strategical standpoint a railway through the Hindu-Kush, with its proposed tunnel 13 miles in length, would seem easy to defend in case of war. The Hindu-Kush mountain chain would be impassable during the greater part of the year, except for the tunnel, which could be readily closed in case of war.

The idea of constructing an Indo-European railway system was first seriously proposed in the year 1873, when the famous engineer, Ferdinand de Lesseps, wrote a letter to Count Ignatieff, the Russian Ambassador at Constantinople, which contained the following words:

In my opinion the construction of a quick means of communication between the West and the Far East through Central Asia will, in an extraordinary degree, increase the facilities of commerce by the sea routes.

I foresee that the realization of this great project, for whatever reasons it be undertaken, will cause Anglo-Russian antagonism to vanish, an antagonism which has been provoked by the position of affairs in the countries of Central Asia. Indeed, twenty years ago, I foresaw similarly that the construction of the Suez Canal would result in the disappearance of antagonism between France and England, an antagonism which had existed from the beginning of the present century on account of the Egyptian question.

As soon as Central Asiatic territory has been intersected by railways, it will no longer act as a hindrance to the spread of European civilization. The ground for mutual distrust between the rival empires of Russia and England will disappear, a distrust which always assumes a marked character as soon as one of these empires tries with armed force to restore order, when it has been broken on these frontiers by semi-barbaric tribes.

The route of the Indo-European railway proposed by De Lesseps was from Orenburg via Samarkand to Peshawar, there to form a junction with the Indian railways. On receiving the full support of Ignatieff, authorized by the Russian Government, De Lesseps set out for Paris. He devoted himself to organizing an expedition for the purpose of surveying the proposed route. The expedition which he had organized went to India, but, on

account of the opposition of the English authorities, was obliged to return from that country without setting to work.

The first indication that the British Government favored the construction of a railway connecting Europe with India appeared in a speech of Sir Edward Grey in the House of Commons on July 11, 1912, when he said:

From the Government's point of view, it would be unwise to oppose the construction of a railway, which in any case, sooner or later, must be built. On the contrary, in order to safeguard our own interests, England is bound unremittingly to take part in the construction of the Trans-Persian line.

It will be noticed from this speech that Sir Edward Grey endorsed the proposal for a Trans-Persian railway. In view of the imperiled position of British influence in Persia and the fact that Turkey is now an ally of Germany, it is perhaps likely that the British Foreign Office would oppose a Trans-Persian railway to India, unless the outcome of the present war should remove all doubts as to whether such a railway would subserve British interests instead of those of the Central Powers. Had such a railway been in existence when the war started it would have facilitated a German-Turkish invasion of India by way of Baluchistan. On the other hand, a railway through the Hindu-Kush would have facilitated the co-operation of India and Russia in the present war.

Mongolia also is likely to be an objective for Russian railway extension and in the future the network of Central Asian railways will probably be connected in the west with Europe and in the south with India. Not only is it likely that the Bokhara railway system will be extended toward Mongolia as well as to India, but it seems also probable that a railway will be built from the Trans-Siberian line to Urga, the capital of Mongolia, whence a line might then be constructed across the Gobi Desert to Kwei-hua-cheng, from which place a line is now being completed to Kalgan to join the Peking-Kalgan railway. Then a branch line may be thrown out west from Urga to Ulyassutai, Kobdo, and Semipalatinsk, which would connect eventually with the Samarkand-Bokhara district railway system. When all this is accomplished Peking would be brought four days nearer to London, and Mongolia would be well under the civilizing influences of western Europe. The wealth of its rich northern portion would be developed, and its fertile valleys put under the plough and form another granary for the world. With the Russian railway systems linked with India's by the proposed extension through the Hindu-Kush, India would then have the opportunity of railway communication, roundabout, to be sure, not only with Mongolia, but also with China, should the railway be built across the Gobi Desert.

In 1914 two agreements were drawn up between Russia and Mongolia, one authorizing a concession to the Russian Central Postal and Telegraph Department to construct a telegraph line into Mongolia, and the other allowing for a co-operation between Russia and Mongolia for the construc-

tion of railways to serve the two countries. The agreement stipulates that, although the Mongolian Government shall have the right to construct a useful railroad with its own means, nevertheless, "as regards the granting of railroad concessions to anyone, the Mongolian Government shall, by virtue of the relations of close friendship with the neighboring great Russian nation, previous to granting the concession, enter into conference with the Imperial Russian Government and consult with it as to whether the projected railroad is not injurious to Russia from an economic and strategic standpoint."

The closing of gaps between the Russian and Indian systems ought to benefit America's own trade relations with India, unless customs duties had to be paid in Russia for transit of goods to and from India and America. The time saved by transit of goods over this route, compared with transportation by sea, should be enormous. A railway service between Europe and India would give great opportunity for a fast parcel post service; up to the present the United States has not arranged parcel post service either with Russia or with India. The recent extension of the Russian railway system to Kola in northern Lapland,² and also the improvement in railway service to Archangel, should make it possible in connection with the proposed extension of the Russian railway system to British India, to ship goods all the way from New York to Arctic Ocean ports in Russia, and then by rail to British India, with no necessity for transfer of the goods either at London or at ports in Germany. As Kola is free of ice all the year round, it could be used for trade even in the winter, but in summer Archangel would be more advantageous, as much distance would be saved in railway haul. Indeed, by making use of steamers and barges on the Northern Dvina and Volga Rivers, with connecting canal, goods could be brought by water all the way to the Caspian Sea and across it to Turkestan, where the present and proposed railway systems could take them to British India. Owing to the high northerly position of Kola and also Archangel, the route to New York is not nearly so long as it looks on the maps in Mercator's projection generally in use for the representation of world routes. In the future America, instead of doing business with Russia or adjacent countries by way of England or Germany and through the Baltic Sea, seems likely to prefer the direct routes to northern Russia. The necessities of the present war, which have compelled the use of Russia's Arctic ports, have also caused their improvement and their better connection with the rest of the country, so that these new routes of commerce may become permanent.

There is no part of the world where railways are so capable of enormous commercial and industrial development as in Russia. The railway policy of the Russian Government is becoming more and more progressive, and as a result peaceful penetration of some of the richest and most secluded portions of the world will proceed rapidly during the years to come.

² See "Russia's War-Time Outlets to the Sea," *Geogr. Rev.*, Vol. 1, 1916, pp. 128-132, with map.—EDIT. NOTE.

THE GUARANI INVASION OF THE INCA EMPIRE IN THE SIXTEENTH CENTURY: AN HISTORICAL INDIAN MIGRATION

By BARON ERLAND NORDENSKIÖLD

There are, as is well known, two important Guarani tribes in Bolivia, the Chiriguanos and the Guarayús. The latter live between the Rio Itonama and the Rio Blanco, in that part of eastern Bolivia which is called after them Guarayos and which lies between the districts Mojos and Chiquitos. The Chiriguanos live in southern Bolivia from the Rio Itiyuro to somewhat north of the Rio Grande, in the outermost valleys of the Andes towards the Gran Chaco and in the Chaco itself.¹

The Chiriguano Indians are mentioned in accounts of the history of the Inca Empire. They occupied much official attention in the first colonial days, and much has been written about them subsequently. Even in the seventeenth and eighteenth centuries their origin and history proved a source of great interest to writers, e. g. Guzman,² Techo,³ Fernandez,⁴ Guevara,⁵ Lozano,⁶ and Charlevoix.⁷

Guzman⁸ relates that in 1526, following an order by Martim Affonso de Souza, four Portuguese, together with some friendly Indians from the coast, left San Vicente (now Santos) to explore the interior of the land. One of the Portuguese, called Alejo Garcia, was famous for his knowledge of the Guarani language. Traveling overland they first reached the Rio Paraná and, going through Guarani villages, came to the Rio Paraguay. They were well received by the inhabitants, whom they persuaded to accompany them westward on the voyage of discovery, from which they hoped to bring

¹ The Franciscan missionary, P. Fr. Bernardino de Nina, in his "Etnografía Chiriguana" (La Paz, 1912), describes (p. 5) the reduced territory now occupied by the Chiriguanos as extending "to the north scarcely as far as Abapó, to the south up to Itiyuro de Yacuibo, to the west as far as Monteagudo (Sauces) and to the east as far as Carandaiti: some hundred leagues from north to south and forty from west to east."

² Rui Díaz de Guzman: *Historia Argentina del descubrimiento, población y conquista de las provincias del Rio de la Plata* (1612), in "Colección de obras y documentos relativos á la historia antigua y moderna de las provincias del Rio de la Plata, ilustrados con notas y disertaciones, por Pedro de Angelis," Vol. 1, Buenos Aires, 1836.

³ N. del Techo: *Historia Provincie Paraguarie Societatis Jesu, etc.*, Liège, 1673; translation in Vol. 4 of Churchill's "A Collection of Voyages and Travels," 6 vols., London, 1732.

⁴ Juan Patricio Fernandez: *Relación Historial de las Misiones de los Indios, que llaman Chiquitos, que están á cargo de los Padres de la Compañía de Jesus de la Provincia del Paraguay*, Madrid, 1726, p. 4.

⁵ Guevara: *Historia del Paraguay, Rio de la Plata y Tucuman*, in "Colección Angelis," Vol. 2, p. 83.

⁶ Pedro Lozano: *Descripción chorographica del terreno, rios, arboles y animales de las dilatadissimas provincias del gran Chaco Gualamba: y de los ritos y costumbres de las innumerables Naciones barbaras e infieles que le habitan*. Córdoba, 1733.

⁷ François-Xavier Charlevoix: *Histoire du Paraguay*, Paris, 1757, Vol. 1, pp. 36, 258.

⁸ *Op. cit.*, p. 15.

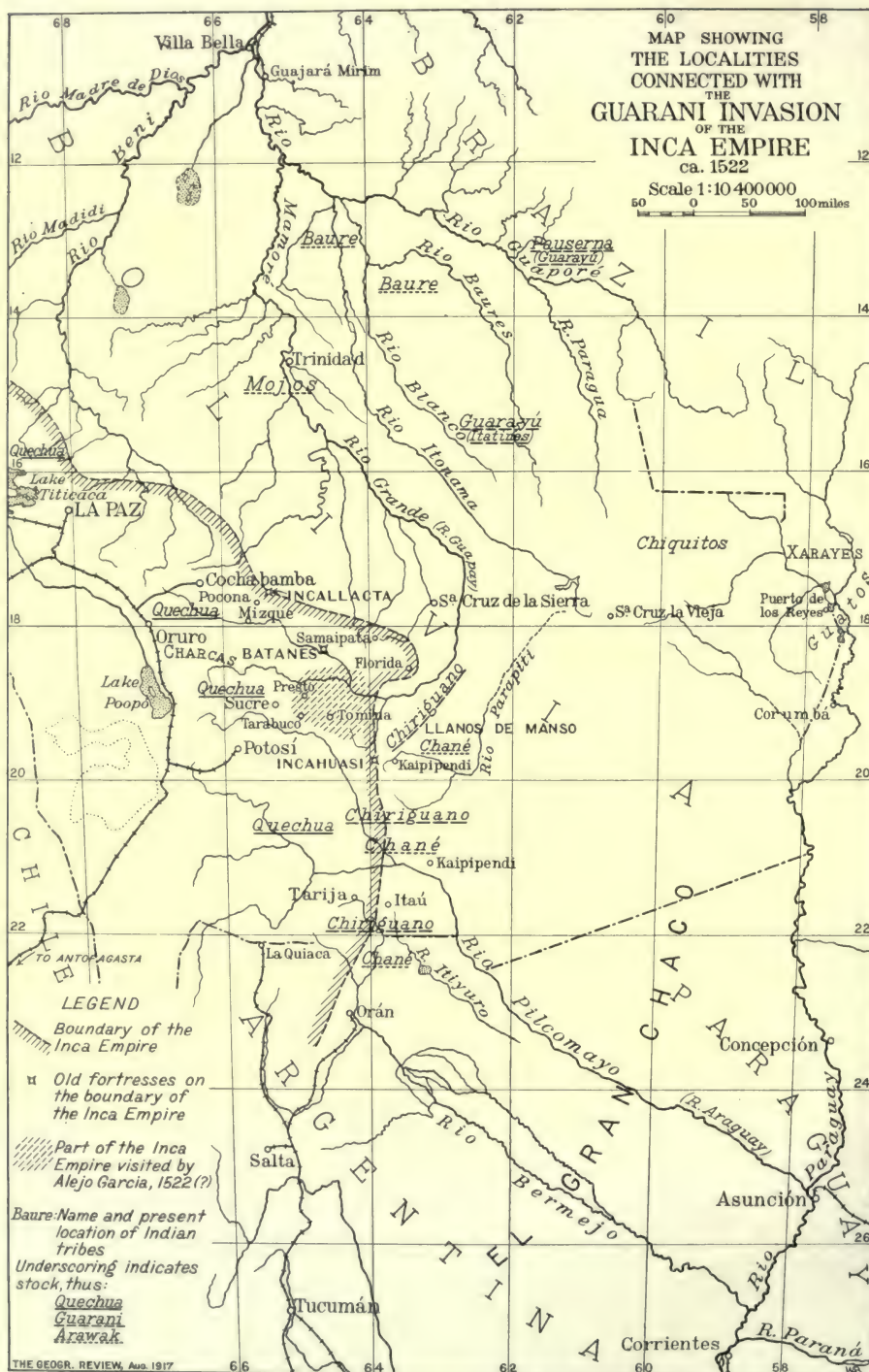


FIG. 1.—Map showing the localities connected with the Guaraní invasion of the Inca Empire, ca. 1522. Scale, 1:10,400,000.

back fine clothes and objects of metal, both for warlike and for peaceful uses.

Accompanied by two thousand Indians they came to a harbor on the Rio Paraguay called San Fernando. Others say that they left the Paraguay River a little north of Asumpeión (Asunción) and, following a stream called Paray, crossed the plains, continuously fighting their way against the inhabitants. After many days' weary march they reached the mountains and invaded Peru in the territory between Mizque and Tomina. There, in some Indian villages ruled by the mighty Inca, they plundered and killed all whom they found. Then they continued for more than forty leagues as far as the outskirts of the villages of Presto⁹ and Tarabuco. Numerous Charcas Indians advanced to meet them here, so they turned, retiring in such good order that they suffered no losses.

In consequence of this attack on their country the Incas had the whole boundary very carefully fortified with strong fortresses, in which they placed large garrisons. The fortresses still exist in these mountains, the Sierras de Cuzco-toro.¹⁰

When the Portuguese with their followers had reached the plain laden with their booty of cloth, clothing, metal utensils, and jewelry of silver, copper, and other metals, they returned to Paraguay by another and better route than that by which they had come, though even this was difficult enough by reason of hunger and war. From Paraguay Garcia sent two of his followers to Brazil to tell Martim Affonso de Souza about their discoveries. They took with them objects of gold and silver brought from the districts they had visited. Garcia, together with his followers, remained with the Indians in Paraguay. There he and his followers were murdered by the Indians, who only spared a boy, the son of Garcia. His name also was Alejo Garcia, and Guzman asserts that he knew him.¹¹ When the two messengers reached Brazil, they told of the riches they had seen in the territory of Charcas, as yet undiscovered by the Spaniards. In consequence of these accounts sixty soldiers under the leadership of Jorge Sedeño left San Vicente. These, too, were murdered by the Indians at the Rio Paraguay and the Rio Paraná. After this a great number of Indians left these parts and betook themselves to the territories where Alejo Garcia had been. Those who were from the Rio Paraná followed the Rio Araguay, better known by its Quechua name of Pilcomayo. It is these Indians who now live on the frontier of Tarija. Those who lived where Asunción now lies "*entraron por aquel rio sobre el rio del Paraguay, y Caaguazú,*" and the Indians higher up the river from Jeruquisaba and Carayazapera entered at San Fer-

⁹ Presto is now a little place situated 75 miles northeast of Sucre, Tarabuco a larger one southeast of Sucre.

¹⁰ Cf. Erland Nordenskiöld: *Forskningar och äfventyr i Sydamerika*, Stockholm, 1915, in which work several sketches of the ruins of these fortresses are published.

¹¹ In order rightly to estimate the value of Guzman's statements, it should be remembered that Guzman's father came to America with Cabeza de Vaca and that his mother was the daughter of Domingo de Yrala.

nando. It is these Indians who now live by the Rio Guapay (Grande) twenty leagues from San Lorenzo in the province of Santa Cruz. There all these Guarani Indians carried on a bloody war with the original settlers and made numerous slaves.

This is a summary of Guzman's highly interesting account of Alejo Garcia's invasion of the Inca Empire and the migration of the Guarani Indians from Paraguay westward.

Lozano¹² quotes Guzman from Teeho and Fernandez, who also reproduce his account. He remarks that the similarity in language between Chiriguano and the language of the Indians in Paraguay speaks in favor of this migration theory, but that it is contradicted by Garcilaso de la Vega, the great authority on ancient Peruvian history. Garcilaso relates that Inca Yupanqui undertook a military expedition against the Chiriguanos. This is said to have been nearly one hundred years before Alejo Garcia's expedition, for Inca Yupanqui lived for many years after his war against the Chiriguanos. His successor was Tupac Inca Yupanqui, who ruled for many years. After him ruled Huayna-Capac, in whose reign "Alexo Garzia" penetrated into Peru.

Of the same opinion as Lozano was Charlevoix,¹³ who also cites Guzman.

Following Garcilaso de la Vega, d'Orbigny¹⁴ assigns Inca Yupanqui's struggle against the Chiriguanos to about 1430 and assumes that the Guarani, who, according to him, emigrated from Paraguay about 1541, mixed most with the Guarani Indians, who lived there first. D'Orbigny is ignorant of the fact that the Chiriguano territory is partly inhabited by another tribe, the Chané.

Of modern authors who have written about the Chiriguanos, Kersten¹⁵ cites Guzman and Garcilaso de la Vega and, like Lozano and Charlevoix, puts more faith in the latter. Serrano y Sanz¹⁶ takes the same point of view. Domenico del Campana¹⁷ cites d'Orbigny. Church either does not know Guzman or ignores him.¹⁸

We see, therefore, that Garcilaso de la Vega is the sole authority for the belief of Lozano, Charlevoix, d'Orbigny, and others that the Chiriguanos inhabited the frontier of the Inca Empire in the Chaco long before Alejo Garcia's expedition. Garcilaso's account of the Inca Empire is, however, not always trustworthy. His description of the Chiriguano Indians is

¹² *Op. cit.*, p. 57.

¹³ *Op. cit.*

¹⁴ Alcide d'Orbigny: *L'Homme Américain*, Paris, 1839, Vol. 2.

¹⁵ Ludwig Kersten: *Die Indianerstämme des Gran Chaco bis zum Ausgange des 18. Jahrhunderts*, Internat. Archiv. für Ethnogr., Leyden, 1904.

¹⁶ Manuel Serrano y Sanz: *Los indios Chiriguanaes*, *Rev. de Archivos, Bibliotecas y Museos*, 1898, July, Madrid. The abundant bibliographical references and quotations from sources make this a particularly valuable work. In sequence (numbers for August to December) are described the Chiriguano attacks on the early Spanish settlers, the viceroys Francisco de Toledo's unsuccessful campaign against this indomitable tribe and other incidents of their participation in colonial history.

¹⁷ Domenico del Campana: *Notizie intorno ai Ciriguani*, Florence, 1902. Contains a short bibliography.

¹⁸ George Church: *Aborigines of South America*, London, 1912, edited by Clements R. Markham from the unfinished MS. left by author at his death.



FIG. 2—A Chané Indian, Rio Parapiti, Bolivia. (Figs. 2-8 are from photos by the author.)

fantastic and full of inaccuracies,¹⁹ and he is clearly contradicted by other authors who were more reliable and less prejudiced than he in their accounts of the Inca Empire.

Thus Cobo,²⁰ whose work on the Inca Empire is regarded as reliable, says, like Guzman, that the Chiriguanos emigrated from Paraguay at the beginning of the sixteenth century. He states that the Chiriguanos penetrated into the kingdom of Peru almost at the same time as, or shortly before, the Spaniards. They left their country in groups and, ravaging as they went, wandered over four hundred leagues through the intervening provinces till they reached the districts bordering on the territory of Charcas. These districts they wrested from the original settlers and peopled in great numbers. Cobo farther on²¹ relates that Huayna-Capac sent his leaders against the Chiriguanos and that the servants of the Incas fared badly.

Sarmiento de Gamboa,²² who is also regarded as unusually reliable, gives a detailed account of the struggles of the Incas against the Chiriguanos. Like Cobo, he first mentions the Chiriguanos under the rule of Huayna-Capac. He tells us how that Inca visited Charcas, thence going to Pocona to give orders respecting the defence against the Chiriguanos and to repair a fortress that his father had built.

Furthermore²³ he relates that while Huayna-Capac was busy with the war in the north against the Cayambis, the Chiriguanos attacked Charcas and took the fortress of Cuzcotuyo, where the Inca had a large border guard against these Indians. They killed the whole garrison and plundered the country. Huayna-Capac received news of this in Quito and sent a chieftain called Yasca to Cuzco to summon the people and march against

¹⁹ Garcilaso de la Vega: *Primera parte de los Comentarios reales*, Madrid, 1723. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vols. 41 and 45, 1869 and 1871.

On p. 244 Garcilaso gives the following incorrect and fantastic description of the Chiriguano Indians:

"Las espías fueron, como se les mando, y bolvieron, diciendo que la tierra era malisima de montañas bravas, cienegas, lagos y pantanos, y mui poca de ella de provecho, para sembrar y cultivar, y que los naturales eran brutisimos, peores que bestias fieras, que no tenian religion, ni adoravan cosa alguna: que vivian sin lei, ni buena costumbre, sino como animales por las montañas, sin pueblo, ni casas, y que comian carne humana, y para la aver, salian a saltar las Provincias comarcanas, y comian todos los que prendian, sin respetar sexo, ni edad, y bebían la sangre quando los degollavan; porque no se les perdiere nada de la presa. Y que no solamente comian la carne de los comarcanos que prendian, sino tambien la de los suyos propios, quando se morían; y que despues de averse los comido, les bolvian a juntar los huesos por sus coyunturas, y los lloraban, y los enterravan en resquicios de peñas, o huecos de arboles, y que andavan en cueros, y que para juntarse en el coito, no se tenía cuenta con las hermanas, hijas, y madres. Y que esta era la comun manera de vivir de la nacion Chirihuana."

²⁰ Bernabé Cobo: *Historia del Nuevo Mundo* (con notas . . . de D. Márcos Jiménez de la Espada), Seville, 1892, Vol. 3, p. 61. The passage reads: "Los indios Chiriguanos, que siendo, como son, valientes y guerreros, casi al mismo tiempo, o pocos años antes que los españoles entrasen en este reino del Perú, salieron ellos, en cuadrillas de su patria, el Paraguay, y corriendo más de cuatrocientas leguas por las provincias que hay en medio, haciendo gran destrozo en los naturales déllas, llegaron á las tierras que al presente poseen confinantes con la provincia de los Charcas, las quales quitaron á sus moradores, y usurpándolas para sí, las tienen agora bien pobladas de los de su nación."

²¹ *Ibid.*, p. 181.

²² Pedro Sarmiento de Gamboa: *Geschichte des Inkareiches*, edit. by Richard Pietschmann, *Abhandl. der K. Gesell. der Wiss. zu Göttingen, Philol. Hist. Klasse*, N. S., Vol. 6, 1906, p. 105. English version in *Hakluyt Soc. Publs.*, 2nd Series, Vol. 22, 1907.

²³ *Ibid.*, p. 109.

the Chiriguanos. In the Collao (the Titicaca Basin region), too, Yasca collected people, whereupon he set off against the Chiriguanos, with whom he waged a fierce war. Yasca took some of these Indians prisoners and sent them to Huayna-Capac in Quito to let him see how curious they looked.

Further confirmation comes from Balboa,²⁴ who says that the Incas and Chiriguanos fought several combats without victory on either side. Like Sarmiento, Balboa says that Yasca sent a number of prisoners to Huayna-Capac. He left new garrisons in the border fortresses. Balboa also relates that when Huayna-Capac was in the Collao, he intended to invade the territory of the Mojos and the Chiriguanos but desisted when he learned of their poverty and savagery.

Cieza de Leon²⁵ speaks of Huayna-Capac's war against the Chiriguanos, saying that the people of the Incas fared badly and returned in flight.

Joan de Santaacruz Pachacuti-yamqui Salcamayhua, too,²⁶ describes the attack of the Chiriguanos on the Inca Empire under Huayna-Capac. He says the Inca sent against them his most skilful chieftains with 20,000 Chinchaysuyo Indians. In passing he mentions the Chiriguanos under "Topayngayupanqui."

Of the authors here referred to who have written on the history of the Inca Empire, it will be seen that Cobo, Sarmiento, Balboa, Cieza de Leon, and Salcamayhua mention the attack of the Chiriguanos on the Inca Empire under Huayna-Capac, while none of them speak of these Indians in connection with any war under any previous Inca. Cobo plainly states that, shortly before or at the time of the discovery of the country by the Spaniards, the Chiriguanos migrated from Paraguay, and thus he confirms Guzman's statements. On the other hand Garcilaso de la Vega says nothing about the invasion of the Inca Empire under Huayna-Capac by the Chiriguanos, and I am inclined to think that by a mistake he assigned an event that happened under that Inca to the reign of his grandfather.

Guzman and his echoes mention a certain Alejo Garcia in connection with the migrations of the Guarani Indians westward. Who really was Alejo Garcia? When did he make his expedition? Were he and his followers the first Europeans to enter the Inca Empire?

To find an answer to these questions I have gone through all the literature at my disposal in which I could hope to find some information about this mystical conquistador and the westward migrations of the Guarani Indians at the beginning of the sixteenth century: in particular I have

²⁴ Miguel Cavello Balboa: *Histoire du Pérou*, in Ternaux-Compans, "Voyages, etc." 2d series, Vol. 4, Paris, 1840, p. 181.

²⁵ Pedro de Cieza de Leon: *Segunda parte de la Crónica del Perú*, in "Biblioteca Hispano-Ultramarina," published by Márcos Jiménez de la Espada, Madrid, 1880, p. 238. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vol. 68, 1883.

²⁶ Joan de Santaacruz Pachacuti-yamqui Salcamayhua: *Relacion de antigüedades deste Reyno del Pirú*. Contained in "Tres relaciones de antigüedades peruanas," Madrid, 1879, pp. 290-291 and 304. English translation in *Hakluyt Soc. Publs.*, 1st Series, Vol. 48, pp. 67-120, 1872. Markham dates the work about 1620.

looked for references antedating Guzman's work. Domingo de Yrala²⁷ states that when Juan de Ayolas began his march in 1537 through the Chaco, setting out from "El Puerto de la Candelaria" on the Rio Paraguay, he found among the Payagoa Indians a slave who had been with a certain Garcia, a Christian who conveyed to the island of Santa Catalyna a quantity of metal. The slave offered to lead him to the place from which Garcia had got this metal. Juan de Ayolas accepted the offer and succeeded in traversing the Chaco, but on the way back he was murdered by the Payagoa Indians. This was told Domingo de Yrala by a Chané boy from the interior of the country. On the Rio Paraguay in latitude 16° 30' Yrala himself met many Indians, ex-slaves of Garcia's, who had fled to this place when the Guaraní Indians murdered him. With these Yrala made a three-days' journey inland to speak with some Guaraní Indians. They told him that it was a 15 days' march to the inhabited districts, and confirmed the fact that it was Garcia who had been murdering and plundering in the region.²⁸ It is clear from Yrala's statement that Garcia went overland from the south coast of Brazil to the Rio Paraguay.²⁹

When in 1543 Alvar Núñez Cabeza de Vaca made his journey to the upper Rio Paraguay, he, too, came across numerous traces of Garcia and of the westward migrations of the Guaraní Indians. Cabeza de Vaca's journey has been described partly by himself and partly by his secretary Pero Hernández, and their accounts strike one as reliable.³⁰ Hernández relates, *inter alia*, that Cabeza de Vaca came to a tributary of the Rio Paraguay called Yapaneme. This was half as wide as the main river and ran into it in latitude 19°. According to the old residents, this was the way that Garcia, the Portuguese, came. With not more than five Christians he had warred in these parts at the head of a large number of Indians; he had fought many fights and had destroyed a number of villages. A mulatto, Pacheco, who had taken part in this expedition, returned to the land of the Guaçani,³¹ by whom he was murdered. Garcia returned to Brazil. The Guaranis who had accompanied him had suffered great losses in the interior, and, said Hernández' informants, there were many individuals of this tribe who could give much information on the expedition and its consequences.³² Hernández relates furthermore³³ that Cabeza de Vaca met Chané Indians whom Garcia had brought with him from the interior. These Indians, he

²⁷ Carta de Domingo de Yrala á S. M. dando extensa cuenta del estado de las provincias del Rio de La Plata, prision de Cabeza de Vaca, etc., 1545. Contained in: *Relación de los naufragios y comentarios de Alvar Núñez Cabeza de Vaca*, "Colección de libros y documentos referentes á la historia de America," Vol. 6, Madrid, 1906, p. 381.

²⁸ Domingo de Yrala, *op. cit.*, p. 392.

²⁹ *Ibid.*, p. 387.

³⁰ *Relación de los naufragios y comentarios de Alvar Núñez Cabeza de Vaca*, in "Colección de libros y documentos referentes á la historia de America," Vols. 5 and 6, Madrid, 1906. The *Comentarios* written by Pero Hernández are translated in *Hakluyt Soc. Publs.*, 1st Series, Vol. 81, pp. 94-262, 1891.

³¹ Guaraní?

³² *Op. cit.*, Vol. 1, pp. 276-277.

³³ *Ibid.*, p. 291. "Algunos destos indios trayan quantas margaritas y otras cosas que dixeron auerles dado Garcia quando con el vinieron."

says, had taken wives in their new country, on the Rio Paraguay. A large number of Chané Indians came to meet the governor (i. e. Cabeza de Vaca), saying that they were well disposed to the Christians because Garcia had treated them well when he took them from their country. Some of them had necklaces and other objects given them by Garcia.

Cabeza de Vaca questioned the Chané Indians on the interior of the country³⁴ and its inhabitants. The chieftain of the Chané Indians, a man of about fifty, answered that when Garcia brought them there they passed through the territory of Maya. They then came to the Guaranis, who killed nearly all Garcia's Indians. However, the chieftain and others of his tribe had succeeded in escaping up the Rio Paraguay to the villages of the Sacoci Indians, where they had been well received. They had not dared to return by the road of the outward journey, lest the Guarani Indians should attack and kill them.

In the Xarayes district, on the upper Paraguay, the emissaries of Cabeza de Vaca met a Guarani Indian from Ytati.³⁵ Among other things, he related that, when he was very young, his tribe had united with all the inhabitants in the district to betake themselves to the interior of the country. He had accompanied his father and his relatives to fight the natives, from whom they took articles and adornments of gold and silver. After suffering a defeat in which a great number of Guarani Indians had been killed, the rest fled, remaining for the most part in the woods, through which they reached the interior. They did not dare to go back for fear of being killed by the Guaxarapo, Guato, and other Indians whose territories they would have to pass. He said that from the plundered villages they had taken many articles of gold and silver, *tembetas*, ear-drops, bracelets, fillets, axes, and little vessels, but that most of these had been recovered by the natives in their successful attack.

Hernández goes on to relate³⁶ that in El Puerto de los Reyes on the upper Rio Paraguay there were some Tarapecoci Indians. Like the Chané, they had come with the interpreter Garcia on his journey of discovery among the villages of the interior and had returned after being defeated by the Guarani Indians on the Rio Paraguay. These Indians said that they were not hostile to the white men, nay, that they liked them after Garcia had been in the country and had traded with them. But they were hostile to the Guarani Indians. Francisco de Ribera, who had visited their fellow-tribesmen in their native country, showed them some arrows from there, which they recognized and were glad to see. These Tarapecoci had gold and silver which they had bartered from the Paycunos, who in their turn had got these metals from the Chanés, Chiménos, Carcaras, Candires, and others.

From the accounts given by Yrala, Cabeza de Vaca, and Hernández we learn a good deal about the migrations of the Indians of this region in the

³⁴ *Ibid.*, p. 292.

³⁵ *Ibid.*, pp. 304-307.

³⁶ *Ibid.*, pp. 329-330.



FIG. 3—One of the Chiriguano villages that line the eastern foothills of the Andes from a little south of Santa Cruz to the Argentine frontier. The Chiriguano village is seldom large, being composed as a rule of eight or ten straw-thatched huts.



FIG. 4—Chiriguano Indians playing a stick game in Tihupia, Bolivia, one of the villages at the eastern foot of the Andes.

beginning of the sixteenth century. We find corroboration of the occurrence of large migrations of Indians from east to west, and of the important part Garcia played in them. Numerous Guarani Indians from Paraguay wandered westward, and a number of them stopped in this region. Garcia took back to the Rio Paraguay Chané and Tarapecoci Indians, with whom he seems to have been very friendly.

Of great interest is the narrative of the Guarani Indian from Ytati on the migrations of his fellow-tribesmen from the Rio Paraguay, and their forced sojourn in the forests. These Indians from Ytati are evidently identical with the group of Guarani Indians who according to Guzman came from Jeruquisaba and Carayazapera on the upper Rio Paraguay and took up their residence on the Rio Guapay, twenty leagues from San Lorenzo in the province of Santa Cruz. In these parts there still lives a considerable tribe of Guaranis, viz. the Guarayú, whom I mentioned at the beginning of this article.

Just as Cabeza de Vaca had done, Nuflo de Chavez³⁷ and Francisco Ortiz de Vergara³⁸ found numerous traces of the westward invasion of these Guarani Indians.

Nuflo de Chavez got a very interesting and partly veracious description of the Inca Empire when he reached the province of Xarayes on the upper Rio Paraguay. He there met "Chirikuanos"—as he calls the Guarani inhabitants—who had taken part in the expedition westward: among them was a chieftain Bambaguazú. He described to Nuflo de Chavez the struggles between the "Chiriguanos" and the Candires, by which latter he meant the Indians of the hills. On the Chiriguanos' side were the chieftain Peritaguari and Moqueringuazú with all his men. There is also mention of "los Taguarinbucus" and of Itapuan's (Itapuy's?) and Guayubai's men. The whole movement was organized by Itapuy. When the "Chiriguanos" had passed the Rio Guapay, they saw the border village of the Candire country.³⁹ They had not succeeded in getting into this village, but had only stolen metal spades and tools from outhouses in the cultivated fields.

It is evident that Chavez got all this information from the "Chiriguanos" who live in Guarayos, i. e. from the Guarayú. It evidently relates to an expedition identical with that described to Cabeza de Vaca by the Indian from Ytati.

³⁷ *Annuæ de la Compañía de Jesús—Tucuman y Perú—1596. Mision ó Residencia de Santa Cruz de la Sierra, "Relaciones Geográficas,"* Vol. 2, p. lxxvi, Madrid, 1885. This includes (p. lxxxliii): *Relación general que se tomó en pública forma y se envió autorizada al virrey en la provincia de los Xarayes que es en 17 grados sobre el Rio Paraguay, 250 [leguas?] de la Asumpcion donde habia llegado el general Nuflo de Chaves con 150 hombres, con orden é intento de poblar en ella, y despues, por la relación que tomó, pasó adelante.*

³⁸ *Al Ilmo. y Rmo. Sr. D. Juan Ovando, presidente del Consejo Real de Indias: Relación verdadera del viaje y salida, que hizo del Rio de la Plata al Peru, Francisco Ortiz de Vergara, su cierto servidor, in "Colección de Documentos inéditos del Archivo de Indias,"* Vol. 4, Madrid, 1865.

³⁹ These ruins should be looked for between Florida and Samaipata not far from Santa Cruz de la Sierra. I have met persons who stated that there were considerable ruins which they supposed to be of Jesuit, but which are presumably of Candire origin.

Ortiz de Vergara,⁴⁰ who in 1565 went from the Rio Paraguay to Santa Cruz in Chiquitos (i. e. Santa Cruz La Vieja) and from there to the Rio Parapiti, relates how the Guarani Indians had ravaged the country. He passed through large uninhabited tracts which the original settlers had abandoned through fear of the Guaranis.

The author of the "Relación Verdadera del Asiento de Santa Cruz [La Vieja]"⁴¹ speaks of the Guarani Indians who lived thirty leagues from that place. He says that there are about 4,000 of them and that they came from the other bank of the Rio de la Plata after having eaten up or otherwise destroyed numerous tribes on the way. He also says that this country is fertile and abounds in fish, game, and wild fruits.

Juan Perez de Zurita⁴² relates (about 1586) that these Itatines (Indians from Ytati) lived 35 leagues from Santa Cruz, in a fertile land of much food and water and great woods.

It is clear from what the Indians told Cabeza de Vaca and Nuflo de Chavez that the group of Guarani Indians who came from the upper Rio Paraguay did not succeed in making any conquests in the Inca Empire but only reached the boundary of that dominion. After their defeat they withdrew to the woods where, as has been stated, their descendants still live.

Unfortunately we cannot follow the migrations of the Chiriguanos in the same way as we have followed those of the Guarayús or Itatines. This is largely owing to the fact that they passed through the trackless wilds of the Chaco, through a region that baffled even the conquistadors of the sixteenth century. The author of the "Relación Verdadera"⁴³ alludes to the numerous attempts to make a road through the Chaco, all of which failed for lack of water or because of inundations.

He also relates that many Chiriguanos, when they passed to settle in the hills, died of thirst and snake-bites.

Blas Garay⁴⁴ has published an anonymous document from the Archivo de Indias which also confirms the statement that the Guarani Indians emigrated from Paraguay to Peru in the reign of Huayna-Capac. The author of this document says that some of the Guarani Indians returned to their country again, and that a thousand settled in the hills. It would be remarkable if the Guarani Indians who settled in the hills and caused the Incas so

⁴⁰ *Loc. cit.*

⁴¹ Relación Verdadera del asiento de Santa Cruz de la Sierra, límites y comarcas della, Rio de la Plata y el de Y-Guapay é sierras del Piru en las provincias de los Charcas, para el exómo Señor Don Francisco de Toledo, Visorey del Pirú, in "Relaciones geográficas," Madrid, 1885, Vol. 2, p. 154.

⁴² Relación de la ciudad de Santa Cruz de la Sierra y su gobernación, calidad de tierra y otras cosas y la cual dió Juan Perez de Zurita, Gobernador que ha sido della, in "Relaciones geográficas," Madrid, 1885, Vol. 2, p. 171.

⁴³ *Loc. cit.*, p. 156.

⁴⁴ Blas Garay: Colección de documentos relativos á la historia de America, y particularmente á la historia del Paraguay, Asunción, 1889. (After Samuel A. Lafone Quevedo: Juan Díaz de Solís, Historia, Buenos Aires, 1903, Vol. 1, p. 180.) Lafone Quevedo assumes that this document was written about 1575 by Montalvo.

much trouble, numbered no more than one thousand.⁴⁵ Cazorla⁴⁶ estimates them, towards the end of the sixteenth century, at less than 600 and, with slaves, at 2,500. That they were comparatively few is confirmed by Lorenzo Suarez de Figueroa,⁴⁷ who distinguishes clearly between the Guarani Indians who lived in the province of "Ytatin" 30 leagues east of Santa Cruz (La Vieja), and those who lived 50 to 60 leagues west of that place. He estimates the latter at 4,000 warriors, not half of whom were true Chiriguano, but mestizos, i. e. sons of these and of women of other tribes. Figueroa adds that they had four to five thousand Indians from "Los llanos del Capitan Andrés Manso," who were their subordinates. We see how, in Figueroa's time, the Chiriguano were generally known as a conquering tribe which, shortly before, had taken possession of the country, a warrior race that had taken wives in a foreign land. However, their expansion seems to have been about the same then as now. In "Relación Verdadera"⁴⁸ we read that they had villages on the Rio Grande, Rio Condurillo (=Rio Parapiti), and Rio Pilcomayo. Their southern boundary was the 22nd degree of latitude.

According to Guzman, the migrations of the Guarani Indians westward began, as we have said, with the expedition of Alejo Garcia, which he asserts took place in 1526. He also says that Garcia was sent out by Martim Affonso de Souza. This last statement must be due to an error, for in the detailed diary in which Pero Lopez de Souza describes this expedition⁴⁹ there is no mention of Alejo Garcia. On the other hand, there is the statement that Martim Affonso de Souza met a certain Francisco de Chaves and five or six Indians on the south coast of Brazil. Chaves told him of great riches in the interior of the country, which induced Martim de Souza to send out an expedition under the leadership of Pero Lobo. The last-named was killed by the Indians. This is confirmed by Hernández.⁵⁰ Pero Lobo's unlucky expedition left the Brazilian coast for the interior in September, 1531.

⁴⁵ The writer of "Carta del Licenciado Matienzo a S. M. sobre los Chiriguanaes, visitas y otros asuntos" (1561) says the Chiriguano numbered 800 to 1,000: they were very dexterous in war, "que cincuenta acometerán á mill y aun á tres mil de los desta tierra." This letter from the Archivo de Indias is one of several documents containing references to the Chiriguano reproduced in the "Juicio de Límites entre el Perú y Bolivia: Prueba Peruana presentada al gobierno de la República Argentina por Victor M. Maurtua," Barcelona, 1906. Vol. 2.

⁴⁶ Carta de Fernando Cazorla, etc., MS. Bib. Nael. (Madrid) J 53, fol. 317, 318. Cf. Manuel Serrano y Sanz, *loc. cit.*, p. 572.

⁴⁷ Relación de la ciudad de Santa Cruz de la Sierra por su Gobernador Don Lorenzo Suarez de Figueroa, in "Relaciones geográficas," Vol. 2, pp. 165 and 167. Dated 2/6, 1586. Written?

⁴⁸ *Loc. cit.*, p. 155.

⁴⁹ Pero Lopez de Souza: *Diário da Navegação 1530-1532*, publicado por Francisco Adolfo de Varnhagen, Lisbon, 1839, p. 29: "Quintafeira desasete dias do mes d'agosto veo Pedro Annes Piloto no bargantim, e com elle veo Francisco de Chaves e o bacharel, e cinco ou seis castelhanos. Este bacharel havia trinta annos que estava degradado nesta terra, e o Francisco de Chaves era mui grande lingua desta terra. Pela informaçam que della deu ao Capitam Y., mandou a Pero Lobo com oitenta homêes, que fossem descobrir pela terra dentro: porque o dito Francisco de Chaves se obrigava que em des meses tornada ao dito porto, com quatrocentos escravos carregados de prata e ouro. Partiram desta ilha, ou primeiro dia de setembro de mil e quinhentos e trinta e hum, os quarenta besteiros e os quarenta espingardeiros."

⁵⁰ *Loc. cit.*, p. 185.



FIG. 5.



FIG. 6.



FIG. 7.



FIG. 8.

FIG. 5—A Chané Indian, Rio Parapiti, Bolivia.

FIG. 6—A Chiriguano Indian, Tihuipa, Bolivia. Note the *tembeta*, or button-like ornament on the chin.

FIG. 7—A Chiriguano woman, Yacuiba, Bolivia.

FIG. 8—A modern Chiriguano burial urn, Kaipipendi, Bolivia.

Garcia seems to have made his expedition to the boundaries of the Inca Empire long before Pero Lobo started his expedition, and before 1526. This appears almost certain from the remarkable letter of the 10th of July, 1528, written by Cabot's fellow-traveler Luis Ramirez from the Rio Solís (Rio de la Plata),⁵¹ in which he relates, *inter alia*, that Cabot met two of Solís' comrades on the south coast of Brazil in 1526, Enrique Montes and Melchor Ramirez, the latter of whom said that he had been on the Rio de Solís as interpreter to a fleet from Portugal. Many of the people in it had remained in the country, and five of them had gone to the hills, where there were said to be great riches and a white king who had proper clothes like theirs. From there they had sent a letter to say that they had not yet reached the mines, but that they had treated with some Indians who were neighbors to the hills and who wore on their heads a kind of silver crown and a kind of gold plate hanging round their necks and in their ears. They had sent twelve slaves and samples of metal and related that they had collected much metal. They invited the others to come to them, but they did not dare to because of the dangers and the many tribes through whose territories they would have to pass. Later had come the news that the Guarani Indians had killed them to take from them their slaves, loaded with metal.⁵²

So far as I can see, there is no reason to doubt that Luis Ramirez' statement is, in the main, correct. It is to be assumed that he exaggerates somewhat when he speaks of the riches discovered. What he writes about the excursions of the Portuguese to the frontiers of the Inca Empire strikes me as absolutely truthful.

To judge by the evidence, he speaks of the same expedition as Guzman, Yrala, and Hernández, i. e. Alejo Garcia's. It appears from Ramirez' account that it must have been some years before Cabot's journey to Rio de la Plata (i. e. before 1526) that the Portuguese made their raiding expedition to the boundaries of the Inca Empire. Huayna-Capac died in 1526.⁵³ It is thus clear that the Portuguese and the Indians from Paraguay raided the boundaries of the Inca Empire in the later years of Huayna-Capac's

⁵¹ Carta de Luis Ramirez: A document copied by F. A. Varnhagen in the library of the Escorial, *Rev. do Inst. Hist. e Geogr. do Brasil*, Vol. 15, 1888, Rio de Janeiro.

⁵² Ramirez, *loc. cit.*, p. 20: "Este tambien dijo mucho bien de la riqueza de la tierra, el qual dijo haver estado en el Rio de Solis por lengua de una armada de Portugal; y el Sr Capitan General por mas se certificar de la verdad desto le pregunto si tenian alguna muestra de aquel oro y plata que decian n'otro metal que decian, los cuales dijeron quellos quedaron alli siete hombres de su armada sin otros que por otra parte se havian apartado, y que destos ellos dos solos havian quedado alli estantes en la tierra, y los demas vista la gran riqueza de la tierra, é como junto á la dicha sierra avia un rey blanco que traia buenos vestidos como nosotros, se determinaron de ir allá, por ver lo que era, los quales fueron y le embiaron cartas; y que aun no habian llegado á las minas, mas que habian tenido platica con unos indios comarcanos á la sierra é que traian en las cabezas unas coronas de plata, é unas planchas de oro colgadas de los pescuezos é orejas, y ceñidas por cintos, y le enviaron doze esclavos y las muestras del metal que tengo dicho, y que le hacian saber como en aquella tierra havia mucha riqueza, y que tenian mucho metal recojido para que fuesen allá con ellos los quales nose quisieron ir á causa que los otros havian pasado por mucho peligro, á causa de las muchas generaciones que por los caminos que havian de pasar havia, é que despues havian havido nuevas que estos sus compañeros bolviendose á do ellos estavan, una generacion de indios que se dicen los Guarenis los havian muerto por tomarles los esclavos que traian cargados de metal,

⁵³ Cieza de Leon, *op. cit.*, p. 259; Cobo, *op. cit.*, Vol. 3, p. 189.

reign. That the Guarani Indians at this period attacked the Inca Empire, we know, as has been mentioned, also through Cobo, Sarmiento, Balboa, and Cieza de Leon.

Thus we see how very strikingly the statements from the authors who have written the history of the Inca Empire accord with those taken from the oldest descriptions of voyages of discovery in the basin of the Rio de la Plata.

As Pizarro and his companions did not reach the most northerly boundaries of the Inca Empire before 1526, it is clear that he and his companions were not the first Europeans to cross the border of that mighty kingdom. *Pizarro had a predecessor in Alejo Garcia.*

The "armada" on which the Portuguese came and plundered the borders of the Inca Empire was, according to Luis Ramirez,⁵⁴ that of Cristobal Jaques. This is a man about whose voyages we unfortunately seem to know very little.

Harrisse points out that in the *islarío* of Santa Cruz mention is made of some islands in the estuary of the La Plata River which are named after Christoval Jaques, who, he says, was a Portuguese who came to this river from the coast of Brazil on account of the report that gold was to be found there. Harrisse says that it is not known how far up the La Plata Jaques went.⁵⁵ In this connection he lays stress on the fact that from the many Portuguese and Spanish ships that visited Brazil and the surrounding territories, seamen must have remained in the country after deserting, being shipwrecked, or abandoned on shore, and then joined some Indian tribe. They then went from tribe to tribe, wandering west and south. Harrisse continues: "In this way we can explain the unvarying tradition of Europeans having descended the great rivers of that part of the country in early times." In a note Harrisse mentions Alejo Garcia.

The most detailed account of Jaques that I have come across occurs in a book published by Lycéo Litterario Portuguez in Rio de Janeiro (1900), called "*Historia Topographica e Bellica da Nova Colonia do Sacramento do Rio da Prata.*" The author of the introduction to this, J. Capistrano de Abreu, assumes, apparently on good grounds, that Jaques undertook two voyages to these parts. On the second voyage he did not reach the Brazilian coast before 1526 or 1527. The first voyage is supposed to have taken place between 1516 and 1521. Of the second voyage we know a good deal: of the first, which is of interest to us, we know very little, unless a document found in the archives of Simanca by J. T. Medina refers to this voyage. This is a letter from the Spanish minister in Portugal, Juan de Cuniga, to King Charles V. In it, Cuniga relates that in 1521 King Manuel of Portugal had sent to the Brazilian coast an expedition which had there met nine of

⁵⁴ Ramirez, *loc. cit.*, p. 37.

⁵⁵ Henry Harrisse: John Cabot, the Discoverer of North America, and Sebastian, His Son, London, 1896, p. 261. See also Franz R. von Wieser: Die Karten von Amerika in dem Islario General des Alonso de Santa Cruz, Innsbruck, 1908, p. 56.

Solis' companions. They had then continued up to a river which was fourteen leagues wide⁵⁶ and had gone thirty-five leagues up the river. There they heard a great deal of the riches in the interior of the country and got from the Indians silver, copper, and gold specimens.⁵⁷ If this was the expedition with which Alejo Garcia went to South America, he must have reached the Inca Empire about in 1522.

Guzman says nothing about *what* Indians the Guaranis met with in the districts where they settled. He only relates that they waged a very bloody war against the settlers and made numerous slaves. Cobo merely says that they conquered from their original inhabitants the tracts where they now live. Nor does Hernández say *what* Indians they were; but he tells us that Garcia had with him Chané and Tarapeocí Indians when he returned to the Paraguay River from his raid through the Gran Chaco. The Chanés are a very well known tribe in the Chaco. *They are Arawaks.* They still live in many parts within the territory of the Chiriguano Indians, as on the Rio Itiyuro in northern Argentina, near the mission of Itau south of the Rio Pileomayo, not far from that river at Kaipipendi,⁵⁸ and above all on the lower Rio Parapiti. Everywhere they give the impression of being a tribe that has been pushed aside. They speak Guarani,⁵⁹ i. e. they are Guarani-ized, and have a civilization much resembling that of the Chiriguanos. It is therefore presumable that Chané Indians constituted at least a part of the original population in the present Chiriguano territory.

The Chiriguanos speak very contemptuously of the Chanés, whom they call *tapuy* or *tapii*, which, according to Corrado,⁶⁰ means that they are derived from something that has been bought. According to the same author they also call them *chirámui chiyari* (= my slave, my female slave), while a Chané addresses a Chiriguano as *cheya* (= my master). I have myself heard Chiriguanos contemptuously call the Chané Indians *cuñareta* (= women).

According to Matienço⁶¹ a number of the Indians who were driven away from the districts conquered by the Chiriguanos settled in the Tarija valley. It is not known what Indians these were.

The Guarayú Indians, or Itatines, presumably conquered, from the Chané and other Arawak tribes, those districts, too, where they now live. In the "Relación Verdadera"⁶² we read that the peaceful Indians who lived

⁵⁶ The Río de la Plata.

⁵⁷ José Toribio Medina: Juan Díaz de Solís, Santiago, 1897, pp. cccxiii-cccxi.

⁵⁸ Not to be confused with the Kaipipendi situated near the Rio Parapiti.

⁵⁹ On the Rio Parapiti they still know a little of their old Arawak tongue. Cf. Erland Nordenskiöld: Indianlif, Stockholm, 1910.

⁶⁰ Alexandro M. Corrado: El Colegio Franciscano de Tarija y sus misiones, Quaracchi, 1884, p. 54.

⁶¹ Memoria del Licenciado Matienço al excelentísimo señor don Francisco de Toledo visorrey del Perú cerca del Asiento de la provincia de los Charcas, sobre el labrar de las minas, in "Colección de documentos inéditos," etc., Vol. 24, Madrid, 1875.

⁶² Relación Verdadera, *loc. cit.*, p. 157: Of the Indians "en frente y al leste de Condurillo [Rio Parapiti]" is said "Estos indios eran naturales de los valles que están á los principios de la Cordillera que poseen los Chiriguano, no de los que hay serca de los Charcas, como algunos han pensado, los cuales, echados de los Chiriguano, se pasaron en aquella asperesa de tierras por escapar de sus crueldades, y defendiéndose bien y multiplicando en gran muchedumbre."

near the lower Rio Parapiti, presumably Chané, had been forced out there by Itatines. In their conquests these Indians certainly met not only Arawaks but also Chiquitanos. It would not surprise me if it was these latter warlike Indians who used the poisoned arrows that drove the Itatines into the woods which their ancestors inhabited and still inhabit.

We thus see that in large tracts of Bolivia now inhabited by Guarani Indians, the Arawaks presumably constituted the original population. In several earlier papers⁶³ I have had occasion to deal with this interesting tribal group, and I am convinced that future investigations will show that they had a still greater extent and importance than we are now aware of.

From the references in the sixteenth-century literature herein quoted, it seems clear to me that Guzman's account of Alejo Garcia and the expeditions of the Chiriguano Indians, described at the beginning of this paper, is in the main correct. Its only inaccuracy lies in associating Garcia with Martim Affonso de Souza and dating his expedition as 1526: it must have been some years earlier.

We therefore see:

(1) That at the beginning of the sixteenth century numerous Guarani Indians emigrated from the Rio Paraná and the Rio Paraguay to Guarayos and to the outermost valleys of the Andes towards the Gran Chaco.

(2) That the districts in which these Indians settled were not previously inhabited by Guarani Indians, but chiefly by Arawaks.

(3) That Alejo Garcia, the Portuguese, was in the Inca Empire before Pizarro.

POSTSCRIPT

When I wrote the above paper I did not have access to Dr. Manuel Dominguez' excellent article on the Chaco. In this he clearly proves that Alejo Garcia was the first European to be in the Inca kingdom, thus arriving at the same conclusion as I had. As Dominguez does not give an account of the migrations of the Indians in connection with Garcia's plundering expedition, which migrations were of primary interest to me, I am still of the opinion that the publication of my paper is fully justified. Dominguez' article was published in the *Revista del Instituto Paraguayo*, Asunción, 1904, a periodical which is of course rare in European libraries. This also accounts for the fact that Dominguez' work is not quoted by several authors whose interest it would have been to know it.

⁶³ E. g. cf. Erland Nordenskiöld: *Urnengräber und Mounds im bolivianischen Flachlande*, *Baessler-Archiv*, Leipzig and Berlin, 1913.

THE CENTRAL ILLINOIS TORNADO OF MAY 26, 1917

By J. P. CAREY

A remarkably large and well-developed cyclone moved across the central part of the Mississippi Basin on May 26, 27, and 28. It was marked by atmospheric conditions that resulted in a number of exceedingly violent tornadoes, among them one of the most destructive that ever visited Illinois. The writer was at the State Normal School in Charleston at the time the largest of the tornadoes passed through and destroyed a part of the city lying about a mile north of the school. The weather conditions were noted

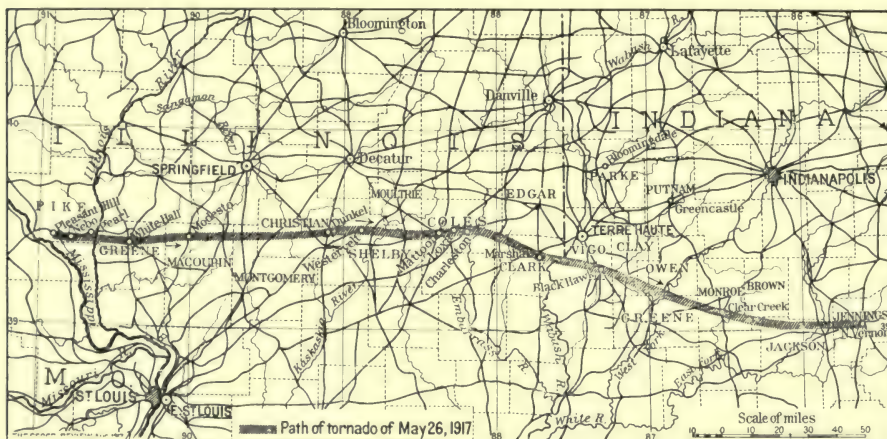


FIG. 1—Sketch map showing the path of the tornado of May 26, 1917, across central Illinois and west-central Indiana. Scale, 1:4,200,000. The names of counties not in the tornado's path are omitted.

before and during the storm, and immediately afterward its destructive effects were observed from near Mattoon eastward for fifteen miles.

About noon of May 26, 1917, a tornado developed in Pike County, Illinois, near the little town of Pleasant Hill. Its path, which is about 287 miles long, stretches over almost the total width of Illinois and three-fourths of the width of Indiana, a length that is seldom attained by tornadoes. This distance was covered in seven hours and twenty minutes, or at an average velocity of about 40 miles per hour. This should not be confused with the velocity of the inflowing wind, which probably reached 400 miles an hour.

The tornado was remarkable for its severity as well as its length and was unusual in that it struck more towns than tornadoes generally do (see map, Fig. 1). It caused the deaths of over one hundred people and destroyed a large quantity of live stock, numerous farm buildings and other improvements, railroad cars, and portions of ten or more towns. These towns vary in size from a few hundred inhabitants to a city of 12,000. A conservative estimate of the total damage to real estate and personal property in Coles County, Illinois, is about \$2,500,000 and for the whole track \$3,000,000.

The greatest destruction was wrought in Coles County, where the tornado struck the districts occupied by workmen's homes in the cities of Mattoon and Charleston, the former with a population of 12,000 and the latter with 6,000. The tornado passed through this county between 3 and 4 P. M., a time of day in which tornadoes are generally most disastrous. In Mattoon, at 3:30 P. M., sixty people were killed, and five hundred homes demolished and others seriously damaged. Traveling at about 45 miles per hour the storm struck Charleston, 11 miles east of Mattoon, at 3:45. Here, thirty-five persons were killed, over four hundred houses and fifteen industrial establishments partially or wholly wrecked, the two railway stations demolished, and all telegraph and telephone connections destroyed.

The width of the storm track varies from one-fourth to one-half of a mile, with an average of one-third of a mile. In some places minor damages resulted over an area about three-fourths of a mile wide to the south of the track. The storm's path indicates that the tornado swerved slightly in some places and in others rose high enough to prevent serious damage. A very good example of this is the case of the hamlet of Loxa, which lies midway between Mattoon and Charleston. Although this hamlet lay in the center of the path, it suffered only minor damages. Had the storm been as vigorous as in the two larger towns, Loxa would have been entirely razed. Another and more pronounced example of the lifting effect was found about four miles east of Charleston and one-half mile east of the Embarrass River. Here a farm house was smashed into splinters, and these splinters were blown a few rods into a gully, together with the farmer and his wife, who were killed, while twenty rods from where the house stood there is scarcely any evidence of vigorous wind action.

Destruction was greatest, in fact complete, in a zone from 500 to 700 feet wide to the right of the storm center's track. The sections of the two cities that were in this part of the storm track, with the exception of the heavier industrial buildings opposite the center of Charleston, were more completely demolished than if a gigantic roller had passed over them, for the buildings were broken into short sticks, split into narrow pieces, and some parts carried rods and even miles eastward. Inspection shows three zones of variable amounts of destruction: first, the zone of complete devastation; second, a zone from 300 to 500 feet wide to the left of the storm center's track, and a similar one of about the same width to the right of the devastated zone, where buildings were demolished beyond repair but not razed; and, third, a zone still farther to the right of the center, where damages decrease outward, from buildings moved to lifted roofs, fallen chimneys, and broken windows (see Fig. 6). The completeness of the destruction is exemplified by the accompanying photographs (Figs. 2, 3, 4, and 5). Objects to the right of the center were moved *forward and in* (east and north), while objects to the left of the center were moved *backward and in* (west and south). Trees and other objects which were near the center were felled either north



FIG. 2.



FIG. 3.

FIG. 2—A section of the devastated district, Mattoon, Ill.

FIG. 3—Coles County (Ill.) fair grounds after the storm. Formerly a beautiful park with numerous show buildings and barns. Nine race horses and a driver were killed here.



FIG. 4.



FIG. 5.

FIG. 4—Wreckage of two elevators at Charleston, Ill. The building at the left was of heavy paving brick. This was near the storm's center.

FIG. 5—Remains of the gas plant at Charleston, Ill., a brick structure.

or south; in fact, the position of such objects furnished the datum for establishing the path of the storm's center.

The reason for the location of the area of complete devastation to the right of the center seems to be plausibly explained when the agents of destruction are considered. On the right of the center the explosive action due to the reduced pressure on the outside of the buildings, the eastward component of the counter-clockwise wind of the tornado (probably over 400 miles per hour), the forward movement of the storm, and the west wind which was prevalent at that time, all worked in conjunction as agents of



FIG. 6—Charleston (Ill.) high school, a building in the zone of partial destruction.

destruction; while on the left side of the center the westward component of the counter-clockwise wind was partially counterbalanced by the forward movement of the storm and the prevalent west wind. A deduction from this is that the greater the rate of transition of the storm, other conditions being equal, the less the destruction to the left of the center. However, the backward or east wind of the storm was strong enough to move an eight-room, one-story house 41 feet to the westward (see Fig. 7), others shorter distances, to break elm trees as large as 30 inches in diameter (see Fig. 8), and to throw down a large number of monuments in a cemetery in Mattoon.

Evidence of the explosive action so frequently cited as the principal agent in tornado destruction is not lacking, but certainly it is not as general as one would expect. The north ends and the east roofs were pulled from some houses in the partially demolished districts; plate-glass windows were broken and fell out, and it is curious to note that the glass in lower sashes was broken more often than in the upper sashes; in one of the churches and in a store in which the glass was supported by metallic strips the windows were made convex, as also were the walls of a barn; one well containing



FIG. 7.



FIG. 8.

FIG. 7—View on the left side of the storm track. The house was moved 41 feet west and 12 feet south from where the man is standing.

FIG. 8—Broken tree overthrown to the west, i.e. on the left side of the storm track.

fourteen feet of water was sucked dry, and a quantity of water and a number of bricks of the curb of another well were removed; every article of furnishing, beds, dressers, chairs, rugs, and a large cedar chest, was sucked from the second floor of one house, and, except for the loss of windows and sashes, the house was uninjured; two negroes were stripped of all their clothing; and many birds were plucked clean of feathers. These cases all testify to the explosive and sucking actions, so-called, of the storm, which were caused by the great reduction of pressure as a result of the centrifugal movement of the air. Although the strong twisting wind appears to have been the chief agent of destruction, it is quite probable that, in and near the center of the storm, explosion was an important factor in preparing buildings for the subsequent crushing action of the wind.

Cases occurred of the well-known phenomenon of objects being driven into trees. Blunt cedar sticks were found imbedded an inch and a half deep in posts, and oat-straws half an inch deep in a maple tree. Another tree was decorated like an Indian's feather helmet. Huge oak and elm trees were twisted off, freight cars filled with brick were upset, as were also the tank cars of the Standard Oil Company. These things, and the buildings moved and crushed, indicate the force of the wind.

That the atmospheric disturbance reached a considerable height or that there was a continuous upward movement of the air, or both, is evidenced by the distance and direction to which mail, pieces of books, photographs, wall paper, and fragments of lath and plaster were carried. A large amount of such material was carried from Mattoon and Charleston to Parke and Putnam Counties, Indiana, according to reports received and mail sent back from Bloomingdale and Greencastle. This means that material was carried from 50 to 70 miles to the northeast, while the storm went southeast.

Phenomena which, for want of an explanation, are termed freaks were quite common. It was not unusual to see a house that was unharmed standing next to a building wrecked beyond repair. One of the accompanying photographs (Fig. 4) shows a section of Charleston in which small houses were not much harmed, while near them two well-built elevators and a number of freight cars were completely demolished. To the east and west of this same dwelling section the destruction was quite complete. This section of minor destruction is directly north of the business part of Charleston, and, although it is as much as three blocks distant from the zone in which the storm was generally effective, a number of store buildings in it were severely wrecked. The inference is that there the storm cloud settled down and covered a wider area, with the result that its force was somewhat dissipated and its destruction more extensive and less intensive.

METEOROLOGICAL CONDITIONS

The U. S. Weather Bureau daily weather map for St. Louis at 7 A. M. of the date of the storm (Fig. 9) shows a well-defined cyclonic area covering most of the interior lowland of the United States. The center of the low,

which has a barometric pressure less than 29.4 inches, is in the vicinity of Sioux City, Iowa. Forty-eight hours later it had moved southeastward, so that the center was about Cincinnati, Ohio, and the pressure near the center of the low had increased to 29.5 inches. This is a movement of 600 miles in 48 hours, or an average of 12.5 miles per hour, an unusually slow rate for the movement of cyclones in the United States. The center of the low was in southeastern Iowa at the time the tornadoes occurred in Illinois; thus

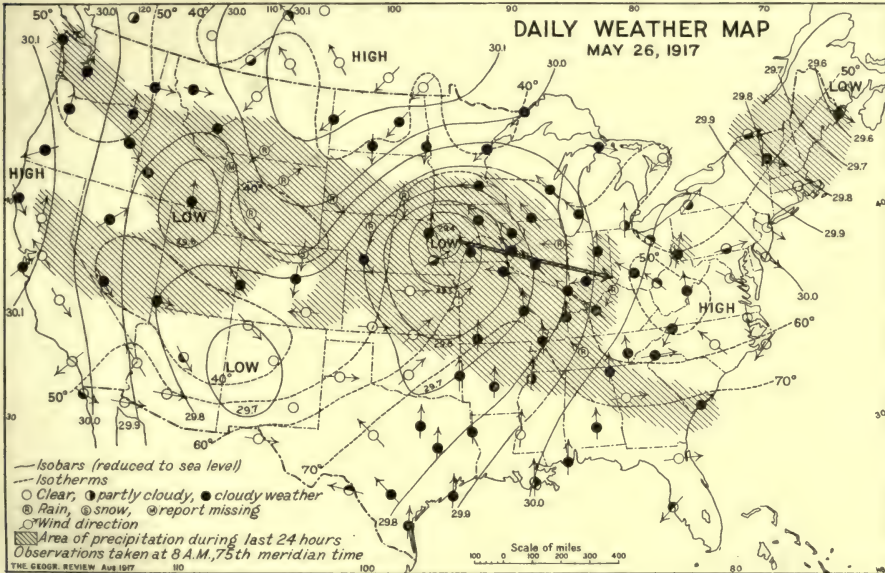


FIG. 9—Copy of the daily weather map of the U. S. Weather Bureau for May 26, 1917, issued at St. Louis, Mo. Scale, 1:42,000,000. The double-line arrow indicates the progress of the low-pressure area from western Iowa to southeastern Indiana during the forty-eight hours from 7 A. M. (Central Time) on May 26 to 7 A. M. on May 28.

they developed in the southeastern quadrant of the low area. This low is remarkable in that the isobaric lines are oval in shape, with their long axis extending north and south. The isobars also show a slight bulge to the south in the southern quadrant—a condition favorable for sudden wind shift. A low of this shape and size in the middle Mississippi Valley in the spring and early summer months is especially favorable for the development of tornadoes. Cloudiness was prevalent and showers were common over most of the Mississippi Valley during the 24 hours preceding the tornadoes.

At 11 A. M. a thunder shower occurred at Charleston. The clouds broke for a short time, but lights were necessary at 2 P. M., and the air was exceedingly sultry and oppressive. At 3 P. M. a heavy, black nimbus cloud appeared in the northwest, and frequent and fierce flashes of lightning occurred. Shortly before 3.45 a greenish-black cumulo-nimbus cloud began to tumble in from the west. The wind suddenly changed from east to west through the south, and hail began to fall. Then the hail lessened in amount

and the wind attained a velocity of probably 80 miles per hour (judging from the trees broken and the material carried), the barometer dropped nearly 0.30 inch and rose immediately 0.40 inch and as suddenly returned to its starting point, the temperature fell 14° and then rose gradually

(see barograph and thermograph records, Figs. 10-11). Suddenly the wind lulled, and flattened spheroidal hailstones, some having a major axis of $2\frac{1}{4}$ inches, fell until the ground was covered. The hail was accompanied and followed by a deluge of rain. The precipitation was 1.81 inches for the 24 hours, and all but a very small part of this fell during the two hours immediately after the passage of the tornado.

Although the funnel or balloon-shaped cloud of the tornado was not visible to those in the cities, because of the trees, it was well described by numerous individuals who were west of the cities and to the right or left of the storm. Most of the people of the two larger cities who observed the action of the clouds maintain that two clouds or storms, one moving southwest and the other northeast, came together. It is curious to note that these reports came from two places eleven miles apart and that observers between the cities reported the funnel cloud. The explanation is probably this: When the view of the lower part of the funnel cloud is obscured, or the cloud has settled very low, the clouds at some distance from the earth and on the right or south side of the storm appear to be and really are coming in from the southwest, while those on the left or north side are moving west and south. The eastward and westward movements of the clouds are not perceptible to the observer in front of the

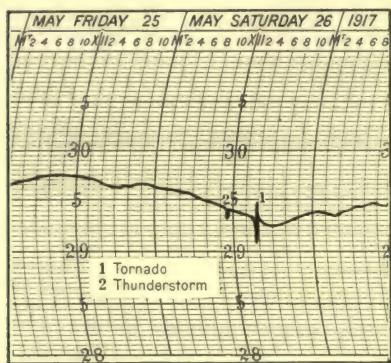


FIG. 10—Barograph record made at Charleston, Ill., one mile from the storm center.

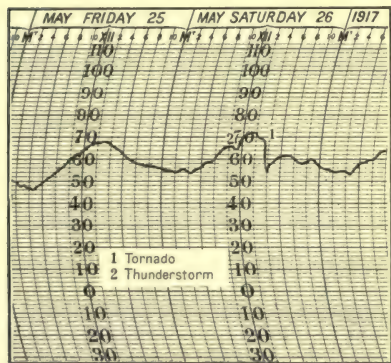


FIG. 11—Thermograph record made at Charleston, Ill., one mile from the storm center.

approaching storm, and he sees only the northward and southward movements, and thus the clouds appear to be meeting. Furthermore, since the clouds on the south and east sides of the storm are moving toward the observer and are on the front of the storm, they are apt to contain more dust and less moisture than the backward moving clouds and therefore appear lighter in color.

RAINFALL TYPES OF THE UNITED STATES

By ROBERT DeC. WARD
Harvard University

IMPORTANCE OF RAINFALL TYPES

"When does the rain come?" is a question the correct answer to which often concerns the farmer and the engineer more than does the answer to the question "How much rain falls in a year?" A relatively small amount of precipitation may be so distributed that most of it comes just when the crops have the greatest need of it. In our own country, great progress has been made in agriculture, especially in the semi-arid regions, through the selection of crops whose periods of growth and of maturity coincide with the season of most abundant rainfall. In earlier years, failure often resulted from an attempt to raise crops which were not adapted to the rainfall type of their particular district. Soil conditions depend to no small degree on the season at which most of the rain falls. There must inevitably be a considerable difference in the processes of weathering between two places, one of which has dry summers and the other of which has rainy summers. The rainfall type is thus both directly and indirectly important in agriculture: directly, as furnishing the rainfall for the immediate use of the plants, and, indirectly, through the relation of the rainfall season to the processes of weathering and of soil formation. The water available for mills, for electric-power plants, for irrigation, for water supply also depends upon the rainfall type. The latter determines the size of the reservoirs, the length of the period needed for the storage of the water, the loss by evaporation, in short, the general availability of the water supply. The desirability of a region as a health or as a pleasure resort depends largely upon the season at which the most or the least rain falls.

OUR RAINFALL TYPES AND THE METHOD OF ILLUSTRATING THEM

The rainfall types here adopted are based upon an examination of a large number of plotted monthly rainfall amounts for selected stations in all parts of the United States and upon a revision, on the basis of these curves, of the rainfall types suggested by General A. W. Greely¹ and by Professor A. J. Henry.² Greely's rainfall types are very simple. There are but six in all. Each has characteristically a single maximum and a single minimum. Each pertains essentially to a single body of water. Composite

¹ A. W. Greely: Rainfall Types of the United States, *Natl. Geogr. Mag.*, Vol. 5, 1893, pp. 45-58, Pl. 20.

² A. J. Henry: Rainfall of the United States, With Annual, Seasonal, and Other Charts, *Weather Bur. Bull. D.*, U. S. Dept. of Agric., Washington, 1897, 58 pp. [Pp. 11-13 and Pl. 1 concern rainfall types.]

Idem: Climatology of the United States, *Weather Bur. Bull. Q.*, U. S. Dept. of Agric., Washington, 1906, 1012 pp. [Pp. 50-51 and Pl. 27 concern rainfall types.]

types are purposely omitted. Henry's classification embraces ten types. Several of these are closely identical with those of Greely. They have been illustrated by means of a series of diagrams showing the monthly rainfall amounts in percentages of the annual means. They include complex (double maxima and minima) as well as simple types. Other suggestions regarding rainfall types are referred to in the general bibliography at the end of this paper.

Each type or sub-type of the present writer's classification is illustrated by a curve showing the monthly amounts of rainfall. These curves are composites. Each one is based upon the records from several (usually five or six) stations, in the same general district. There is a distinct advantage in using a composite instead of the curve for a single station. When the data for several stations are combined, individual local peculiarities and errors, arising from the topography, the altitude, the exposure of the gauge, and from other local controls, are to a considerable degree neutralized. For the purposes of a general comparative study, the composite curve is thus more useful than the curve for a single station. Two things should be borne in mind when considering rainfall types. First, it must not, of course, be expected that the curve for any individual station will necessarily agree absolutely with the type curve for the district, which is a composite. These composite curves show the dominant type of rainfall distribution over the areas for which they have been selected as illustrations. Many individual stations over these same areas naturally depart more or less from the type, especially towards the margins of the areas. Second, the distribution of rainfall at a station in any given year often differs considerably from the general type, which is based upon the records of many years.

Each of the accompanying curves is plotted on the same scale. The height of the diagram therefore gives, at a glance, an indication of the amounts of rainfall. The approximate annual rainfalls over the district for which the curves are representative are noted in each case. Although the type, and not the amount, is here under discussion, some general idea of the monthly amounts of precipitation is inevitably gained by even a hasty glance at the curves, and it will be useful, in our further study of rainfall, if we incidentally learn something about the annual amounts. The general location of each type is indicated on the accompanying map (Fig. 1). The solid black lines indicate the climatic subdivisions or provinces of the United States which have been suggested by the present writer.³ These provinces form a convenient and rational basis for a discussion of the climatology of the United States. Although suggested and adopted for other reasons, these subdivisions are on the whole well adapted for use in our present investigation. Except in the few cases where well-

³ R. DeC. Ward: *The Climatic Subdivisions of the United States*, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672-680. [Abstract in *Monthly Weather Rev.*, Vol. 43, 1915, pp. 467-468.]

defined mountain barriers intervene, as in the case of part of the Sierra Nevada-Cascade and Rocky Mountain divides, one rainfall type naturally merges gradually into the neighboring one. There are, therefore, few sharp division lines. The boundaries shown on our map are not to be taken as indicating sudden transitions.

RAINFALL TYPES OF THE EASTERN CLIMATIC PROVINCE

The outstanding fact regarding the seasonal rainfall over most of the great area which lies east of the Rocky Mountains is the predominance of summer rains. Such a distribution is entirely in accord with the general

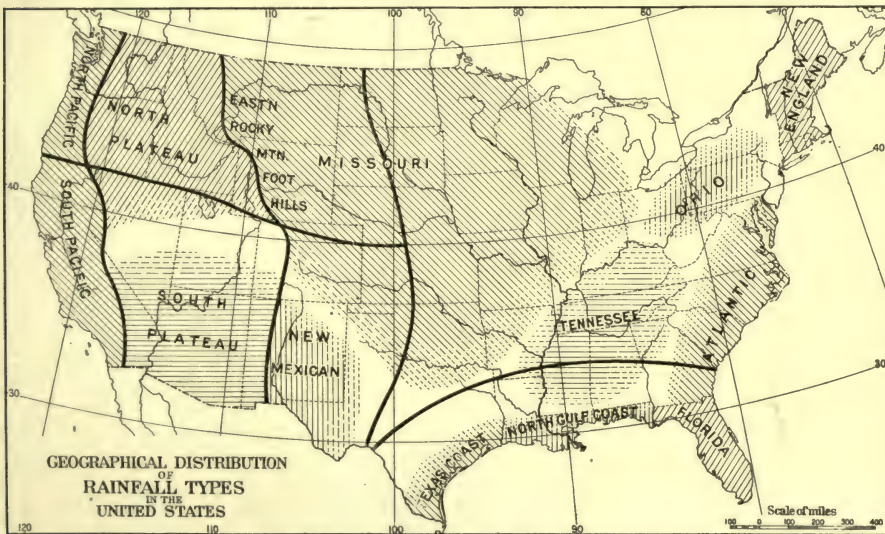


FIG. 1.—Outline map, 1:42,000,000, showing, in ruling, the distribution of the rainfall types and, by heavy black lines, the climatic provinces of the United States. The latter, which are left nameless above, are taken from a map on p. 678 in the article by the author cited in footnote 3, above. Proceeding from east to west the names of the climatic provinces are: Eastern Gulf, Northern Plains, Southern Plains, Northern Plateau, Southern Plateau, Northern Pacific, Southern Pacific.

continental character of the climate of this area as a whole. Warm-season rains are typically the rains of continental interiors. They occur when the continental indraft of the warmer months brings in warm, damp air from the surrounding water areas and when high temperatures favor local showers.

The most characteristic rainfall type of our Eastern Province, both because it covers the largest area and because its curve so emphatically indicates continental control, is that which, following Greely, is named *Missouri*. This type prevails over most of our Plains Province, extends eastward well over the prairie states and into the Great Lakes region, and is found as far south as northern Texas. Figure 2 is a composite curve illustrating the Missouri type. The winter precipitation is very light.

Most of the year's supply of rainfall comes in late spring and early summer. The maximum is usually in June. Similar conditions are found over the Russian steppes, as pointed out by Woeikof. This type of rainfall brings the maximum at the season when rainfall is most needed by the crops. While such a distribution may be of relatively little importance in a region where the total annual precipitation is more than enough for agricultural uses, it is obviously of great moment where the year's rainfall at best scarcely suffices for the demands of our staple crops. Fall-sown grain over most of the Eastern United States grows little or not at all in winter. It makes a rapid start in spring, and therefore the months from April to August are the most critical for our Eastern staple crops.

While the area embraced by the Missouri type is very extended, the general character of the curve is maintained with extraordinary persistency. Towards the margins of the district, to the east, south, and west, certain modifications are noted. A number of stations around the Upper Lakes, e. g. in eastern Minnesota, eastern Wisconsin, the upper peninsula of Michigan, etc., have the Missouri primary maximum in June and a secondary maximum in September. In going east, also, as the vicinity of the Lower Lakes and of the Ohio Valley is reached, the precipitation of the winter months becomes distinctly more marked. We may, therefore, set apart the *Ohio* type, whose general location is indicated on our map (Fig. 1) and whose curve is illustrated in Figure 3. The continental summer maximum of the Missouri type, here somewhat retarded into July, is still clearly shown, but the increase in winter rainfall and the resulting smaller annual range are marked. The location of

this Ohio area in a part of the country where cyclonic rainfalls are both frequent and abundant, and where the winter and spring cyclones from the Southwest and from the Gulf of Mexico are particularly heavy rain-bringers, sufficiently explains the wet winters of the Ohio type. The winter precipitation of the Ohio type is heavier than that in the Great Lakes region generally and is more often rain, while over the Great Lakes themselves, especially the Upper Lakes, more snow falls.

Still farther east the distribution of rainfall through the year becomes more and more uniform, especially as we approach that interesting north-eastern section of our country which, sooner or later, comes within the rain

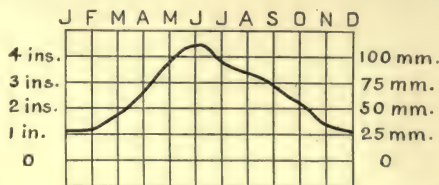


FIG. 2—Missouri type. Mean annual rainfall, 20-30 inches.

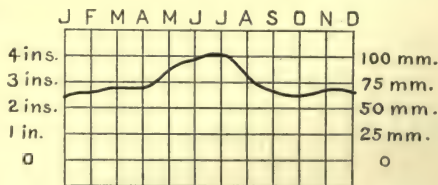


FIG. 3—Ohio type. Mean annual rainfall, 35-40 inches.

area of most of the storms which pass over the United States. In the type which we may call *New England* we have the most uniform distribution of precipitation which prevails anywhere in our whole country (Fig. 4). The variation from month to month is too slight to be of any economic

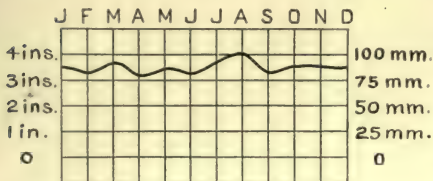


FIG. 4.—New England type. Mean annual rainfall, 40-45 inches.

importance. Droughts are about as likely to occur in one season as in another, but are, of course, more critical in summer. Throughout the year there is usually enough water to keep the rivers well supplied and available for power. We can hardly speak of any maxima and minima, although August, in the long run, is somewhat the rainiest month. This, as will be seen in a moment, is a marked characteristic of our seaboard district along the southern Atlantic coast. The New England curve is obviously affected by controls which dominate the rainfall types of adjacent regions. Some of the stations show a tendency to a slight November maximum, which is a characteristic of the St. Lawrence Valley (Greely). This uniform distribution of rainfall is seen, more or less clearly, over the area directly west and southwest of New England. New York City, Philadelphia, Washington, all have rainfall curves which do not differ greatly from the composite shown in Figure 4, or from the curve of Boston. With increasing distance from the coast, the tendency toward a mid-summer (July) maximum becomes more marked.

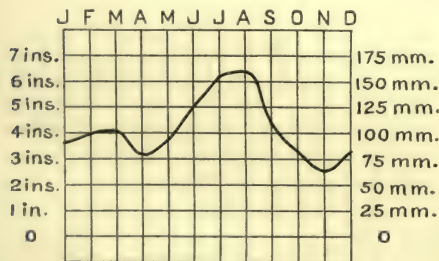


FIG. 5.—Atlantic type. Mean annual rainfall, 45-50+ inches.

Farther south, over the Atlantic Coast states lying between Virginia and Florida, there is a well-defined late summer maximum, usually in August; a minimum in middle or late autumn (October or November); a secondary maximum in late winter (March); and a secondary minimum in spring (April). Von Hann has selected the Atlantic coast of North America in latitude 40°N. as being a typical example of extra-tropical coast rains with a dry spring. The remarkably uniform distribution of rainfall throughout the year is peculiar to this particular district. The percentages of rainfall by seasons are as follows:

Dec.-Feb.	March-May	June-Aug.	Sept.-Nov.
24	23	27	26

This type, which is best termed the *Atlantic*, gradually merges on the north into the very uniform rainfall distribution just considered, which attains its most characteristic development in New England. On the south,

the Atlantic type merges into that of Florida. Figure 5, based on records from stations in North and South Carolina and Georgia, illustrates the Atlantic type. The late summer maximum, which is best marked on the coast, is controlled by the frequent and heavy thundershowers of the warmest months, together with the additional precipitation which comes in connection with occasional West Indian hurricanes. The winter rains result from the general cyclonic storms of that season. The Atlantic type, with its abundant supply of rainfall throughout the year, is obviously well adapted to furnish water-power at all seasons, while its warm-season maximum is favorable for crops.



FIG. 6—Tennessee type. Mean annual rainfall, 45-55 inches.

Over the whole great region east of the Rocky Mountain divide there is but one rainfall type which has a single maximum in winter. This prevails over Tennessee and parts of the adjoining states, especially those immediately to the north and south, and was therefore named the *Tennessee* type by Greely. Because of its prevalence over the southern portions of the Appalachian Mountains, Henry has called it Southern Appalachian and Tennessee. The curve given in Figure 6 illustrates this type. There is a single maximum in late winter or early spring (March), and a well-marked minimum in mid-autumn (October), when the general storm control is relatively inactive. Droughts are not infrequent in the autumn, with damage to crops. Towards the margins of the Tennessee area, both on the east and south, the tendency to a second maximum in middle or late summer is very noticeable. The warm and damp southerly winds of the cyclonic storms of late winter and spring which cross this area on their way north from Texas or the Gulf are responsible for the heavy rainfall of the Tennessee maximum, just as they bring the winter rains of the Ohio type, previously noted. These late winter and early spring rains not infrequently cause floods in the rivers of this region. Topography is an important factor in causing locally excessive precipitation.

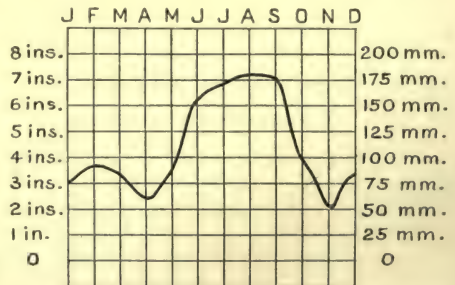


FIG. 7—Florida type. Mean annual rainfall, 50-55 inches.

RAINFALL TYPES OF THE GULF PROVINCE

The Gulf climatic province is overlapped, on the north and northeast, by the Tennessee and the Atlantic types. Its own rainfall distribution is

rather complex and cannot be generalized into a single type. As a whole, the rainiest season is late summer or early autumn. These conditions are satisfactorily explained by the fact that the warm and moist prevailing summer winds over this area come directly from the Atlantic Ocean and from the Gulf of Mexico, that thunderstorms are of frequent occurrence, and that local cyclonic depressions and West Indian hurricanes contribute their share of precipitation. Although our Gulf Province is a small one, three distinct rainfall types may be distinguished. The type which may well be called the *Florida type* is distinctly tropical in character (Fig. 7). June to

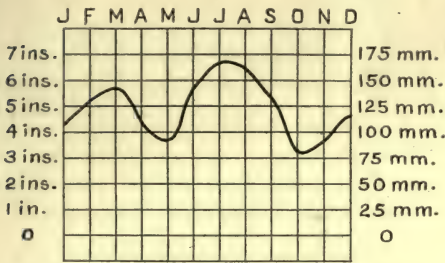


FIG. 8—North Gulf Coast type. Mean annual rainfall, 55-60+ inches.

September constitute a true rainy season. August and September are generally the rainiest months. These are local convectional rainfalls. Florida is also much exposed to tropical hurricanes, which all too often bring their characteristic destructive gales and flooding downpours. A faint secondary maximum is noted in winter. Because of the dry autumn and spring in northern Florida much interest has there been taken in sub-surface and surface irrigation. Along the northern Gulf coast there is a complex type which we have called the *North Gulf Coast type*, with a late winter and early spring secondary maximum, similar to the primary

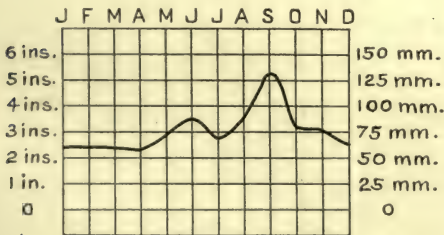


FIG. 9—Texas Coast type. Mean annual rainfall, 25-45+ inches.

This we have designated the *Texas Coast type*. The curve is so different from the two other curves of the Gulf Province that it deserves a special name, although it occupies but a limited area on the coast of Texas. Farther inland, Texas stations show more and more tendency towards an earlier maximum, like that of the Missouri type, and there is an intermediate belt of country in which a transition type is found, with the September maximum of the coast and the early summer maximum of the interior.⁴

⁴ A. W. Greely: Some Peculiarities in the Rainfall of Texas, *Bull. Philos. Soc. of Washington*, Vol. 12, 1892, p. 53.

RAINFALL TYPES OF THE PLAINS PROVINCE

The dominant rainfall type over the Northern Plains is that already described as the Missouri (Fig. 2). The economic importance of this type of rainfall is much greater over the Plains, where the annual rainfall is either insufficient or barely sufficient for agriculture, than it is farther east, where the annual precipitation is heavier and the season at which the rain comes makes less difference. It may without exaggeration be said that, if a man were allowed 20 inches, or less, of precipitation a year and were told to distribute this amount throughout the year so that

it might be of the greatest benefit to the crops over an area like that of our northern and central Great Plains, he could not devise any type of distribution more favorable than that of our Missouri type. The moisture which supplies these beneficent rains comes chiefly from the Gulf of Mexico, but probably also to some extent from the waters of the Great Lakes. The spring and early summer maximum is essentially due to thundershowers, both those which are simply local convectional overturnings of heated air (heat thunderstorms) and those which occur in connection with the relatively weak cyclonic depressions of the hotter months. These summer rains are important in supplementing the water supply which is obtained by the use of the rivers. As pointed out by Greeley,⁵ "it is well known that the annual rainfall is small, yet eastern Nebraska receives, during these four months, April to July inclusive, a larger amount of rainfall than the interior portions of the eastern states from Maine to Virginia; and western Nebraska receives only a slightly lesser amount." These rains of spring and early summer are either of direct benefit, in falling upon the growing crops, or of indirect benefit, in coming at a time when they are of most use for irrigation. It is readily seen that there is a distinct

advantage in having the rainfall maximum over before the harvesting season. Hay and grain may thus be left outdoors with little danger of injury by rains. The relatively dry autumns are favorable to the occurrence and spreading of "prairie fires," about which much used to be heard. The very moderate winter precipitation, which is mostly snow except in the southern sections, has the advantage of being generally so light and dry that the cattle ranges are not rendered inaccessible. It is, furthermore, an excellent protection for the forage grasses and keeps the soil from freezing

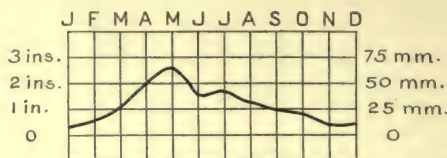


FIG. 10—Eastern Rocky Mountain Foothills type. Mean annual rainfall, 10-15 inches.

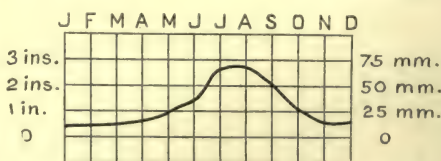


FIG. 11—New Mexican type. Mean annual rainfall, 10-15 inches.

⁵ *Op. cit.* in footnote 1.

deeply. In the foothills, the winter winds blow this light snow into the gullies and hollows, leaving much of the open country bare for grazing.

The Missouri type extends well into the climatic province of the Southern Plains, but, as is to be expected, the simple type illustrated in Figure 2 gradually loses its distinguishing character and becomes more complex. Thus, in eastern Colorado, in western Texas, and in Oklahoma, for example, we find many transitional types which show the ear-marks of adjacent rainfall types of different character and often have two maxima. Along the eastern base of the Rocky Mountains, chiefly in the Northern Plains Province but also extending across into the Southern Plains Province, the maximum comes in May (or even April) rather than in June. This may be considered a slight modification of the pure Missouri type and may be called the *Eastern Rocky Mountain Foothills* type (Henry). The curve is shown in Figure 10, and its general location is indicated on the map (Fig. 1).

In the southwestern corner of the Plains Province, in New Mexico, and in extreme western ("Trans-Pecos") Texas, there is a simple rainfall type, illustrated in Figure 11, with a dry winter and a well-marked mid- or late summer rainfall maximum (July-August). This somewhat resembles the Missouri type, but has drier winters and a later maximum. The winters of this type, which we call the *New Mexican*, are dry because the district is well removed from sources of moisture and because it is visited by but few cyclones, of which not many bring precipitation of consequence. The summer rains come in local thunderstorms, which occur with great regularity, frequency, and intensity over the heated mountains and plateaus of this semi-arid area. Most of this summer precipitation is available for crops only indirectly, through irrigation. The rainfall of this type comes mostly in showers of comparatively short duration. Outdoor occupations are thus seldom long interrupted by wet weather.

RAINFALL TYPES OF THE PLATEAU PROVINCE

The rainfall types of the great inter-mountain Plateau Province are interesting because of their transitional character. As a whole, the dominant characteristic of the rainfall distribution west of the Rocky Mountains is the cold-season maximum (except over the southern portion of the Southern Plateau Province). This is especially marked on the Pacific Slope. The summer maxima east of the Rockies and the winter or spring maxima west of them are found more or less commingled in the Plateau Province. Thus we here find a combination of the marine rainfall régime of the Pacific coast and the continental régime of the interior.

Two well-defined rainfall types may be distinguished, one in the north, the other in the south. The rainfall distribution over the Northern Plateau Province, which may be called the *North Plateau* type, is illustrated in

Figure 12. We have here a winter maximum (December-January), marine in character, and a mid- or late summer minimum (July-August), but there is a distinct increase in the rainfall towards the end of winter, reaching a secondary maximum in late spring (May). This is a continental feature, not found on the narrow Pacific coast. Some stations in this district have one maximum only, in spring, but July and August are the driest months at all the stations. The Missouri, or Eastern Rocky Mountain Foothills type, is sharply separated from the North Plateau type by the Rocky Mountain barrier. The seasonal variation of rainfall is by no means as marked as it is west

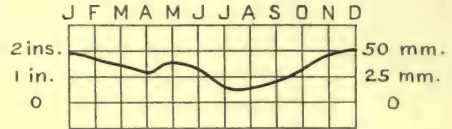


FIG. 12.—North Plateau type. Mean annual rainfall, 10-20 inches.

of the Sierra Nevada-Cascade barrier. These winter rains or snows of the North Plateau type are brought by the general cyclonic storms of the colder months, the moisture coming very largely from the Pacific Ocean. The spring and summer rains are mostly of thunderstorm origin. This North Plateau type of rainfall overlaps somewhat the southern boundary of our Northern Plateau climatic province, being found, as indicated on the map (Fig. 1), in northern Utah and in northern and northwestern Nevada. A few stations in the belt of country fringing the mountains in western Nevada share in the Pacific type of rainfall (see below), which here overlaps the Sierra Nevada from the west. The spring rains of Figure 12 are economically of much importance, either directly, because they fall when the crops are making their early growth, or indirectly, because applied through irrigation. As Messrs. L. J. Briggs and J. O. Belz have pointed out in an interesting report,⁶ spring wheat is not successful over much of this region because sowing cannot begin until late on account of the spring rains. Fall-sown wheat, on the other hand, has the benefit of the winter and spring rains and matures before the dry season of July and August. There is so little chance of rain during the "dry" months that grain is often left for days in the open air, piled in sacks, before being taken to storage. The winter snows on the mountains are economically important in maintaining the summer flow of the rivers, which otherwise, in the summer dry season of this province, would then have little or no water.

As we progress southward from the Northern Plateau Province into central and southern Nevada and Utah, a gradual change takes place in the rainfall type. In place of the late spring maximum of the North Plateau type, we find a more and more marked late summer (July-August) maximum, with a secondary maximum in winter. The primary minimum comes in spring and early summer (May-June), the secondary minimum in autumn (October-November). Figure 13 illustrates what we have named the *South*

⁶ L. J. Briggs and J. O. Belz: Dry Farming in Relation to Rainfall and Evaporation, *Bur. of Plant Industry Bull.* No. 188, U. S. Dept. of Agric., Washington, 1910, 71 pp.

Plateau type. This is a complex curve. It shares in the characteristics of the New Mexican on the east and of the characteristic rainfall distribution of the Pacific Slope on the west. It is on the whole most clearly developed in Arizona, but is found, often with more or less complication, over most of the Southern Plateau Province, including western Colorado and southeastern California. On the higher summits and slopes of the Colorado mountains

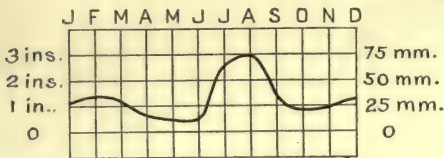


FIG. 13—South Plateau type. Mean annual rainfall, 10-15 inches.

most of the precipitation occurs in the colder months. States like Nevada and Utah, situated among three or four different rainfall types, naturally show considerable diversity and complexity in their rainfall types. In the South Plateau type, one-third or more of the annual rain-

fall comes in the months of July and August. The rainy season begins very suddenly, but there is a slow and moderate decrease towards the autumn minimum. The summer rains, which are very persistent, are afternoon or evening thundershowers of local convectional origin, occurring chiefly over the heated mountains and plateaus of this region, but also overlapping, to some extent, the adjacent valleys and plains. There is considerable variation in the annual amount of these rains. This fact suggests some more or less direct cyclonic control which is probably to be found in the permanent "Yuma low" over the lower Colorado. Water vapor from the Gulf of California is brought by the prevailing southerly winds on the eastern side of this low and is condensed as rainfall over the higher elevations. Weak secondary cyclonic depressions, moving eastward from the Yuma low, also seem to contribute a share of this summer rainfall. It is not improbable that the supply of water vapor from the Pacific Ocean is greater in summer than in winter, because the westerly winds are not likely to deposit as much moisture during their passage across the Sierra Nevada in the warmer season. The winter rains are cyclonic. They are more or less sporadic like the summer rains, occur in connection with low-pressure areas, are under the same general control as the winter rains of the Pacific coast, and depend for their intensity, amount, and distribution upon the character, development, and movement of the winter cyclones. The principal rainy season of the South Plateau type comes after the time of maturity of the staple crops, which are here dependent upon irrigation. The cold-season rains help winter pasturage, and the winter snows, where they fall, protect the grass. The snow which forms much of the winter precipitation on the higher mountains is important in maintaining a supply of water for irrigation in the interval before the late summer rains come.

RAINFALL TYPES OF THE PACIFIC PROVINCE

Our Pacific Province (i. e. the Pacific Slope west of the Cascade-Sierra Nevada divide) has well-marked winter rains, with wholly or nearly rain-

less summers. The rainy season usually extends from October or November to March or April. Over much of the area more than one-half of the annual rainfall comes in the period December-February. The rainiest month is generally December. At some southern stations it is February. The control of what has been termed the Pacific type of rainfall is to be found essentially in the equatorward migration of the cyclonic storm belt of the prevailing westerlies with the advance of autumn and winter and in the northward movement of this same storm belt in spring and summer. These are known as sub-tropical rains. They were first known and studied in the classic Mediterranean region of the Old World.

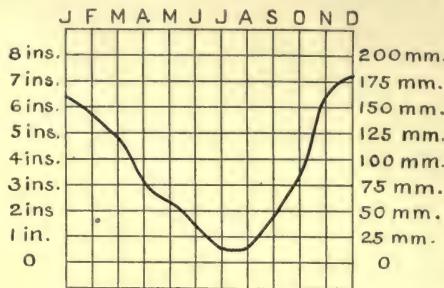


FIG. 14—North Pacific type. Mean annual rainfall, 40-50+ inches.

Later they were found, with similar characteristics, in Chile, on our Pacific coast, in southwestern Australia, in South Africa. In Washington and Oregon, and in northernmost California, the winter maximum is due to the fact that the land is then cold and that the westerly winds and their storms are then most active. Light rains from weak cyclonic depressions keep the warmest months from being absolutely dry. Farther south, while local thunderstorms may occur on the mountains in summer, the lower slopes and valleys are practically, or altogether, rainless. Both lowlands and mountains are warm and do not cool the winds as they do in winter. The length and intensity of the dry season increase from north to south. In the San Joaquin Valley, for example, three or four months may be rainless.

The essential difference in rainfall type between the northern and the southern sections of our Pacific Province is found in the character of the summer "dry" season, whose control is found in the northward withdrawal of the storm belt and its replacement by the northward extension of the margins of the trade-wind belt. For convenience, the state boundary between Oregon and California may be taken as the line roughly separating these two types of Pacific rainfall, although, as just pointed out, northernmost California is similar in its rainfall type to Oregon and Washington. To the north we have what we may call the *North Pacific* type (Fig. 14), with significant midsummer rains. To the south we have a *South Pacific* type (Fig. 15), extending over 500 or more miles along the coast, with wholly or practically rainless summers. This latter condition is of essential economic importance in making it possible to leave the harvested cereal crops outdoors, uncovered, during their removal to more permanent storage places, and in providing an unusually favorable opportunity for sun-drying fruits like raisins and apricots. On the other hand, the precipitation of the

colder months furnishes moisture for the fall-sown crops, which grow slowly through the winter months and are ready for harvesting at the end of the rainy season. The winter is the season when vegetation is green and fresh. In summer the landscape is brown and gray except where there is irrigation. The snowfall on the higher mountains provides the water necessary for irrigation when the winter rains are over. Afternoon thundershowers

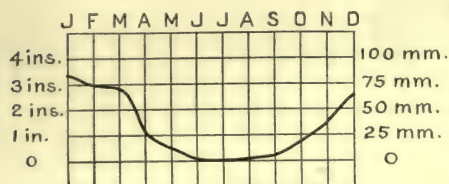


FIG. 15—South Pacific type. Mean annual rainfall, 10-15 inches.

and occasional light rains occur in some summers. In California, the rains of April and May are of the greatest value to agriculturists. No matter how abundant the winter precipitation may be, it is the rains of April and May which are the critical ones.

"RAINY SEASONS" IN THE UNITED STATES

It is clear from an examination of the foregoing curves that certain portions of the United States have distinct rainy seasons. Such rainfall types as the Missouri (Fig. 2), the Florida (Fig. 7), the New Mexican (Fig. 11), the Pacific (Fig. 14 and 15), in which there is a well-marked variation in the rainfall during the year, have rainy seasons. On the other hand, obviously, the Ohio (Fig. 3), the Tennessee (Fig. 6), and above all the New England (Fig. 4) types have so uniform a distribution of rainfall that to speak of rainy seasons is out of the question. These conditions of seasonal rainfall have been graphically presented by Professor Mark W. Harrington in a series of four charts of our "rainy seasons."⁷ Districts which have equal percentages of their annual rainfall in their "rainy season" are enclosed by lines indicating that from 30 to 40, 50, or even 60 per cent of the annual amount comes in the two or three rainiest months. The area with over 30 per cent in the months of May, June, and July covers the northern and central portions of our Plains Province, reaches into the Upper Lakes region, and extends eastward as an elongated and narrowing zone as far as Pittsburg, Pa. (Missouri type). In the far Northwest, the percentage of rainfall in these three months is 50 per cent of the total. The 30 per cent line for July and August embraces eastern Arizona, practically all of New Mexico, and the western angle of Texas (New Mexican type). Most of this area has over 35 per cent in its rainy season. The 30 per cent line for July, August, and September reaches from Pensacola, Fla., to south of Cape Hatteras and includes Florida (Florida type). On the Pacific coast, with its marked winter maximum, December to February bring over 50 per cent of

⁷ Mark W. Harrington: Rainfall and Snow of the United States, Compiled to the End of 1891, With Annual, Seasonal, Monthly and Other Charts, *Weather Bur. Bull. C*, U. S. Dept. of Agric., Washington, 1894. Atlas and text. [Chart 20 and pp. 24-25 concern rainy seasons. The four charts in Bulletin C are combined in one in the Atlas of Meteorology, Pl. 19; text, p. 19.]

the annual rainfall in southwestern Oregon and over all of California except the extreme southeast (Pacific type). These charts show clearly the uniformity of precipitation throughout the year over most of the Eastern Province and the characteristic occurrence of summer rains east of the Rocky Mountains. West of longitude 114° W. over 30 per cent of the yearly rain falls in winter. Harrington has also shown the location of the maxima and the minima of rainfall by means of lines drawn centrally through areas where a maximum or a minimum occurs in any month.⁸ The most noteworthy features of these charts are the enormous area, east of the Rocky Mountains, with a June maximum; the extension of the winter maximum from the Pacific Slope inland and eastward generally as far as the continental divide; and the fact that the minimum rainfall area is more extended in winter than at any other season.

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[Note: In this series of papers the author presents charts showing the rainfall for each month by lines of equal departure from the rainfall norm, or "equipluves." The norm is the amount of rainfall that would occur at any place on the assumption that such rainfall was evenly distributed throughout the year. In other words, the usual *monthly* rainfall averages are expressed as percentages of the *annual* value at each station. This norm is shown by the equipluve of 100. Charts of the wettest and driest months and of rainfall regions are given, as well as diagrams of rainfall intensities.]

Idem: Rainfall and Agriculture in the United States, *ibid.*, pp. 267-274.

Summaries of Climatological Data by Sections, *Weather Bur. Bull. W.*, U. S. Dept. of Agric., Washington, D. C., 1914, and later dates. [Text, maps, diagrams.]

[Note: The earlier work of Blodgett, and especially of Schott, contains much that is still of interest and of importance in connection with our rainfall types.]

⁸ *Loc. cit.*, Charts 19 and 21; text, pp. 23-25.

GEOGRAPHICAL RECORD

NORTH AMERICA

The Economic Causes of New York's Supremacy as a Port. In the *Greater Port of New York Supplement* of the *New York Evening Post* for June 20, 1917, Professor Emory R. Johnson reviews the economic factors operating in the growth of New York as a port. In 1797, when the exports of New York state first exceeded those of Pennsylvania, New York became the first port of the country. Since that date the state and the city have always occupied the premier position in import trade, and only for a limited period in the thirties and the forties has New York been ousted from the first place in the list of exporting states. The temporary superiority of Louisiana gained by the cotton trade and Mississippi navigation had been eclipsed even before the Civil War created a unique opportunity for the ports of the North. Prior to 1860 New York owed much to her coastwise trade. Primarily this rested on her splendid geographical advantages—an excellent harbor, a central location between the manufacturing Northeast and the agricultural South and a direct water route via the Erie Canal to the West. In 1825 the port registered the arrival of 4,000 coasting vessels against 1,400 from foreign ports.

To New York the Civil War brought a trade increase both absolute and relative. Closure of the Mississippi route turned traffic east via the railroads and the Great Lakes and the Erie Canal and thus concentrated commercial movement on New York to an unprecedented extent. Tonnage on the canal in 1862 was double that in 1859. A part of this remarkable increase, due, as it was, to an outside and temporary cause—grain failures in England—also helped permanently in the consolidation of New York's foreign commerce. Of the entire country's exports in 1860 New York claimed 24 per cent: a decade later the city's share had risen to 50 per cent. Retardation of progress in the South and expansion in the Middle West continued to give the advantage, with few counterbalancing influences.

In recent years, however, a tendency towards decentralization has arisen, and New York's share of both import and export trade has been diminished, the former to about 55 per cent, the latter to 35 per cent, though last year's trade, with its vast export of war material, shows a return to the proportion of three decades ago. At the same time the absolute gains have been large. Even before the war New York had become the greatest world port in respect of tonnage, outranking London in both 1912 and 1913 (compare the article by O. P. Austin in the same issue of the *Evening Post Supplement*). Nor is the city's ultimate supremacy menaced. Diversification and territorial spread of industry and the acquisition of new markets in South America and across the Pacific are offset by certain advantages: superior transportation facilities, a vast reservoir of diversely skilled labor, and the cumulative effects of established financial leadership and commercial organization.

Immigration after the War. In 1914 the surplus of alien immigration over emigration contributed over 900,000 souls to the population of the United States. In 1915 and 1916 combined it has not reached one-third of this figure. The future course of the movement is a matter of interested speculation. To secure a basis of prediction the United States Chamber of Commerce recently sent out a questionnaire to various organizations in close touch with the country's alien and naturalized residents (*Information*, March, 1917, New York). Replies in response to it indicate opinion strongly tending to the belief that immigration will be resumed in volume at the close of the war, though it may be some time before the high pre-war figures are again reached. A large exodus of people going to the relief of distressed relatives is also anticipated, but it is believed that this outward movement will be temporary only.

Rainfall and Agriculture in the United States. One of the papers mentioned by Professor Ward in the bibliography at the end of his article in this number of the *Review* is of special and present interest, as it deals with the relations between agriculture and rainfall in the United States (B. C. Wallis: *Rainfall and Agriculture in the United States*, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 267-274). The states are grouped, first on the basis of rainfall, secondly, on the basis of agriculture. On the latter basis the groups are named The Cereal States; The Cotton States; The Northeastern States; The Central Eastern States; The West Coast States; The Mountain States. The mixed nomenclature indicates the difficulty of devising a systematic agricultural grouping.

By means of tables the periods of sowing and reaping the principal crops are clearly shown. The shortness of length of growing season in the Northern States stands in sharp contrast to the longer season in the South. Many interesting deductions are made, among them: "(1) Harvesting operations do not generally occur in the month of greatest rainfall; (2) Generally the summer crops are sown just preceding the wettest season and the winter crops just following it."

Other sets of tables bring out the comparative production of the principal crops as well as the relation of length of growing season and amount of rainfall to successful crop production. The rank of a state is determined by computing the production of a crop per square mile of the total area. On this basis Indiana is classed as the best winter wheat state in the Union. Another interesting deduction is stated "that the growing period of maize in the cotton states is very prolonged and this should be associated with the very poor yield per acre which is obtained." This statement implies a causal relation which is to be doubted in view of the fact that larger yields per acre of corn have been produced in some of the Southern States than in the states of the corn belt. Although the methods employed of computing agricultural rank of the states and some deductions from the data submitted are open to question, the paper presents much very valuable material.

N. A. BENGTSON.

Hail in the United States. As a fitting supplement to recent Weather Bureau work on the origin, mechanism, and distribution of thunderstorms, Professor A. J. Henry has made a study of hail in the United States (*Monthly Weather Rev.*, Vol. 45, 1917, pp. 94-99). The compilation of hail statistics upon which this investigation is based was undertaken because of the immediate necessity for a knowledge of the approximate frequency of hail in this country. An earlier attempt (*ibid.*, Vol. 26, 1898, p. 546) was not wholly successful because the data then available were incomplete. The new chart of annual hail frequency shows that the region of most frequent occurrence (four or more storms a year) is in southeastern Wyoming and eastward therefrom, including the western portions of Kansas, Nebraska, and Oklahoma. Adjoining this region, especially to the eastward, the average number of storms per annum decreases to three over practically all of South Dakota, Nebraska, Kansas, the western and central portions of Iowa, the northwestern third of Missouri, all of Colorado, and the southeastern portion of Wyoming. East of the Mississippi the annual average is two storms a year. A second region of hail frequency is found in southwestern Montana and southern Idaho and the mountain districts of New Mexico and northern Arizona.

Hail is in general a phenomenon of the warm season. The only notable exception is the immediate Pacific Coast from San Francisco northward. There hail occurs chiefly in November to March. In the warm season, hail is closely associated with thunderstorms and tornadic phenomena. Practically no damage to agricultural crops by hail is possible in the Pacific Coast States, and only small damage is possible in the Gulf States, both by reason of the infrequency of the phenomenon and the absence of crops at the time of greatest frequency. One hail insurance company in Iowa has, during the last twenty-four years, paid on an average \$77,525 a year for hail losses. Professor Henry's paper is illustrated by means of five charts, showing the average number of days with hail, by seasons and for the year, for 1906-1915.

R. DEC. WARD.

East Indians in the West Indies. It is not perhaps generally appreciated that to the already mixed racial composition of the West Indies a new element is steadily being added. For some years past in fact the increase of population in Trinidad and British Guiana has been due almost entirely to immigration from India. In British Guiana the census of 1911 showed 126,517 of East Indian origin out of a total of 296,041. Trinidad, with a total population of 333,552, numbered 108,606 of the same origin, and in other islands the proportion of this element is increasing to a degree whereby it promises to hold the majority at some time in the future. Practically all the East Indians come out under contract with the West Indian governments as indentured laborers to work on the sugar and cacao plantations. Their contracts bind them for five years, but they are also required to remain in the colonies for another five, during which they are free to take up land or to work for whom they please. As a body they have gained a reputation for hard work and thrift. During the period of indenture many of them save enough money to purchase land, and the number of land owners among them grows steadily. The common procedure is to buy a few acres of forest land from the government, clear it and plant it with cacao or coconut trees, utilizing the space between the trees for "ground provisions." When the trees begin to bear, in five or six years time, his little property assures the owner an independence (Watson Griffin: *Canada and the British West Indies: Report on the Possibilities of Trade under the Preferential Agreement*, Chapter 8, Department of Trade and Commerce, Ottawa, 1915).

An Eruption of Poás Volcano, Costa Rica. C. T. Mason publishes in *Dun's Review* (*International Edition*) for January, 1917, a set of five photographs illustrating an eruption of Poás volcano, a phenomenon whose occurrence has been seldom recorded. Poás volcano (8,785 feet in elevation) occupies a central location in the volcanic chain of northern Costa Rica. The active crater, a large circular basin, holds a lake of turbid green water of high temperature and strongly sulphuric. The ordinarily placid surface of the water is disturbed at irregular intervals by geyser eruptions of varying degrees of intensity. According to Pittier (*Kostarika: Beiträge zur Orographie und Hydrographie, Petermanns Mitt. Ergänzungsheft No. 175*, pp. 13-14, 1912), the column of water thrown into the air during an eruption of 1888 only reached a height of 6 to 9 feet, while during a period of seismic activity in the succeeding year he himself witnessed an eruption in which the column ascended to 230 feet and lasted for 15 to 19 minutes. (For an account of the volcano and its activities see also Karl Sapper: *Die mittelamerikanischen Vulkane, Petermanns Mitt. Ergänzungsheft No. 178*, pp. 112-117, 1913; for a description of a visit after the eruption of 1910 see A. S. and P. P. Calvert: *A Year of Costa Rican Natural History*, New York, 1917.)

At present access to Poás volcano is difficult, but a road 30 miles long would put it into communication with San José and open up a district with considerable possibilities as a tourist and health resort.

EUROPE

Audibility of Gun-Firing Over the Southeast of England. Messrs. Miller Christy and William Marriott have investigated the audibility, in England, of the gun-firing in Flanders, and also the meteorological conditions under which the firing was heard (*Quart. Journ. Roy. Meteorol. Soc.*, 1916, pp. 267-285). The observations were made in Essex County, in southeastern England, about 125 miles northwest from Ypres, that being taken as a fairly central point in Flanders around which there has been exceptionally severe land fighting. The point of observation was about 155 feet above sea level, without any higher ground in the immediate vicinity. In fact, there is no higher ground between this point and Ypres. The observations were continued during a period of eight months. The maximum distances at which the firing has been heard seem to be about 220 miles from the firing line, during the great British "push" in July, 1916, and about 300 miles on two other occasions, once during the naval battle in the North Sea, January 24, 1915, and again at the time of the naval battle off Jutland Bank, May 31, 1916.

A study of the meteorological conditions shows that gun-firing was most frequently heard where there was a light or moderate breeze blowing between north and east and when the sky was cloudy or overcast. The most favorable pressure conditions are those when there are irregular or poorly defined areas of relatively low pressure with a slight elevation of pressure between them. Calms or light airs then prevail at the surface, while the upper currents may be moving faster than the lower and from a slightly different direction. Under these conditions the sound waves are probably refracted in the upper currents and reflected downwards to great distances. The popular superstition that heavy gun-firing brings rain may possibly have its source in the fact that conditions favorable for audibility are also conditions favorable for heavy rains of a thunderstorm type.

R. DEC. WARD.

The Project of Draining the Zuider Zee. In January, 1916, North Holland suffered a flood disaster from the Zuider Zee said to be the worst on record since 1825. The catastrophe greatly revived interest in the ancient, much discussed project of draining the waters of the inland sea, and now a bill for the purpose has been introduced before the Netherlands Parliament. The project calls for the construction of a dam from the northern end of the province of North Holland via the island of Wieringen to the coast of Friesland. Including the island, the length of the proposed dam will be 24 miles: it will cut off 882,000 acres of the upper waters of the Zuider Zee and of these it is proposed to drain some 500,000. The time required for complete execution of the undertaking is estimated at fifteen years and the cost of the dam, drainage, and various protective works is placed at \$90,000,000. The measure is complicated by the number of diverse interests involved. Among other considerations it must take into account indemnification of the fishing and shipping activities that will suffer thereby (*Commerce Repts.*, Jan. 19, March 30, Oct. 11, 1916, and March 9, 1917).

ASIA

Completion of the Amur Railroad. Passengers from Vladivostok to western Russia need no longer make use of the Chinese Eastern Railway section of the Trans-Siberian line: the all-Russian route has now been completed by the opening, in October, 1916, of

the Kabarovsk bridge (*China Maritime Customs Statist. Series Nos. 3 to 5 (Returns of Trade and Trade Repts.)*, 1916, Part 2, Vol. 1, Shanghai, 1917, p. 8). This great bridge, one of the longest in the world (8,523 feet), crosses the Amur where the railroad turns south to leave the basin for Vladivostok (compare note on "Siberian Traffic Problems," *Geogr. Rev.*, Vol. 1, 1916, p. 461).

A Flood Survey of the West River in Southern China. The Canton delta and the lower Si-kiang, or West River, in southern China were the scene of disastrous floods in June, 1914. At Wuchow the waters rose 22 feet in twenty-four hours. A year later a survey was undertaken for the regulation of the river, particular attention being paid to the region between Wuchow and the sea. Parts of the report submitted by the chief engineer, Captain G. W. Olivecrona of the Swedish army, to the Board of Conservancy Works at Kwantung, are reprinted in the April, 1917, issue of the *Far Eastern Review* (pp. 413-417). This account is of interest because the occasion was the first on which the hydrography of the region was systematically investigated by a staff of foreign engineers.

Rising in eastern Yunnan, the West River first flows south, receiving additional waters from rivers originating in the lakes of the Yunnan plateau, and then northeast, to the meeting point of the boundaries of Yunnan, Kweichow, and Kwangsi. Down to this point it is known as the Pa-ta-ho. From here it flows east along the frontier between Kweichow and Kwangsi and then southeast and east-southeast across Kwangsi province to Sünchow (110° E.), during which part of its course it is called Hungshui, which means "red water," from the color of its silt. Finally in its lower course it becomes the Si-kiang, reaching the sea in four branches known as Junk Fleet, Motomoon, Futinmoon, and Ngaemoon. Except in its last stretches and for a distance of about 90 miles above its mouth the river and its tributaries flow through rugged country. Its drainage basin covers an area of 130,000 square miles.

Of the tributaries, the Liu Kiang is the largest on the left. Its width and depth at the point of confluence are greater than those of the Hungshui, and for this reason it has sometimes been mistaken for the main river. But in the opinion of the surveying commission, the Liu Kiang is to be considered as a tributary, albeit the larger, because the length and the drainage basin of the Hungshui are greater. Another important left tributary is the Pepan-kiang. The major right affluent is the Yu-kiang, which joins the West River at Sünchow; it is navigable to Nanning (108° E.) all the year for shallow-going motor-boats and junks and for nine months as far as Poseh (106° E.).

To prevent flooding of the low country the commission recommended that the present dyke system be improved by additional construction and that the dykes be maintained to a sufficient elevation. Much of the economic prosperity of the Canton delta depends on the control of the rivers which reach it. The upper reaches of the affluents of the West River are subject to heavy rain storms which cause great accumulation of water. To regulate this excess is the problem which the Board of Conservancy Works at Kwantung is trying to solve and for which the surveying and hydrographical observation work was carried on.

The Proposed Indo-Ceylon Railway. A continuous railway net extending from north of the Arctic Circle (Narvik, 68½° N.) to within six degrees of the equator (Pointe de Galle) may become an accomplished fact if, in addition to the proposed connection of the European and Indian railway systems, discussed in Mr. Baker's article in this number of the *Review*, the projected linking of Ceylon with the Indian mainland is carried out (*Engin. Suppl. of the London Times*, Jan. 26, 1917, p. 35, based on a paper by F. J. Waring before the Institution of Civil Engineers). Recent extension of the South Indian Railway to the eastern point of Rameswaram Island and of the Ceylon Railway to the western point of Mannar Island leaves between the two systems a gap of little more than twenty miles. The possibility of closing the gap is suggested by the existence of the well-known Adam's Bridge. Superficially the bridge is of sand, in part above water level and for a portion of its length overlying rock at no great depth. It divides the shallow channel of Palk Strait from the comparatively deep Gulf of Mannar. Water levels in the two channels vary according to the action of the strong, steady monsoon winds which blow alternately in opposite directions against the bridge. In conjunction with the asynchronous tides a maximum difference of 18 inches is established between the levels on either side of the bridge. The action of the local currents thus set up is complicated, and the railroad engineer has to face an interesting problem.

HUMAN GEOGRAPHY

Telephone and Telegraph Development as an Index of National Culture. Civilization advances by the interchange of products—material and spiritual. Measure-

ments of the degree of or facility for interchange are indices of civilization. In a suggestive paper, "The Culture of the Nations" (*Bull. Amer. Geogr. Soc.*, Vol. 43, 1911), Jefferson selected four such indices to arrive at an estimate of world civilization, and on its basis he classified 69 countries into four cultural classes. The indices were schooling, commerce, development of railways, and use of the mail. With his conclusions, though based on statistics of earlier date, the latest available telephone statistics make interesting comparison (*Telephone and Telegraph Statistics of the World*, January 1, 1914, Amer. Telephone and Telegraph Company, New York City).

The fifteen countries ranked by Jefferson in the highest class all have a comparatively highly developed use of the telephone. All have 50 or more telephones to 10,000 population and most of them have over 150. Countries of the lowest culture, including all Africa except Egypt and the Union of South Africa and Asia except Japan and Asiatic Russia, have only 2 or less telephones per 10,000 inhabitants. Telephony also has made little headway in South American countries falling in the lowest rank—Bolivia, Peru, and Colombia with 10 per 10,000. At the other end of the scale in South America are Argentina and Uruguay. Uruguay has 100 telephones per 10,000 population, Argentina 90. In these two countries, unlike the remainder of the continent, the pure Indian element is practically non-existent.

Of greatest interest is the telephone distribution in the countries of the first rank. Most striking is the leadership of the United States, where internal commercial movement is also great. The United States has 970 telephones to the population unit. Canada is second with 650. Distribution in these countries may well be compared with Huntington's maps of the distribution of civilization and of human energy on the basis of climate ("Civilization and Climate," New Haven, 1915, p. 200). The first practical telephone was an American invention.

Besides Canada other British colonies with responsible government make a good showing in telephone usage. In these new countries, where other means of communication are not yet well developed, the telephone and telegraph assume special importance. The latter in particular figures with a high proportional development where there are great areas scantily populated. In this relative development of the telegraph Canada leads with 250 miles of wire to 10,000 population; New Zealand has 240 miles and Australia 220. The United States has 190 miles and Argentina, where the progress of colonization bears many resemblances to that of the Anglo-Saxon type, has 160 miles per population unit. All greatly exceed figures in Europe.

Turning to telephone statistics in Europe we find a surprisingly high development in the Scandinavian countries. Denmark has 450 telephones per 10,000 people; Sweden 410, Norway 340. Here are countries which are adapted both through race and geographic position to very high cultural rank. In Jefferson's scale, however, Norway and Sweden appear at the end of the first class. This is largely due to the comparatively feeble development of their railways, itself attributable to difficult physical conditions. On the contrary an enterprising and well-educated people is ready to take advantage of an appropriate means of communication. The progress of telephony has been closely followed by the Scandinavian countries. For several years Stockholm has led the world's cities in the number of telephones per capita: today the number per 10,000 population is 2,410, where for the twelve largest cities of the United States it is 1,130. In proportion to the figures for these northern countries the number for France, 80 per 10,000, seems remarkably low. Here, however, as in Great Britain, the employment of telephone service met considerable opposition from the well-developed telegraph systems. In France there is a higher proportional development of the latter than in any other European country.

GEOGRAPHICAL NEWS

Meteorological Bibliography. Those who need to use current meteorological bibliographies will be interested to know that a change has been made in the bibliography regularly published in the *Quarterly Journal of the Royal Meteorological Society*. Beginning with the issue for January, 1917, the subject-headings and numbers used in the "International Catalogue of Scientific Literature" have been adopted. This is a distinct improvement over the method previously followed in this publication, which was purely alphabetical.

R. DEC. WARD.

OBITUARY

DR. ROBERT BELL, associated with the Geological Survey of Canada since 1857 and its director from 1901 to 1906, died on June 18 at Rathwell, Manitoba, in his seventy-sixth year. For a period of over forty years he was actively engaged in the geological

exploration of Canada. His work dealt mainly with the Laurentian Plateau, that vast area of archaic rocks which surrounds Hudson Bay in the form of a horseshoe. The extent and wide distribution of the areas he examined, together with his habit of describing the broad, general features of a region, impart a high geographical value to his publications. The most important among these are: On the Geology of the Northwest Coast of Lake Superior and of the Nipigon District, *Rept. of Progress of the Geological Survey of Canada for 1866-69*, pp. 313-364, with a map, 1:253,440, embodying an original survey of Lake Nipigon; Report on an Exploration between James Bay and Lakes Superior and Huron, *ibid. for 1875-76*, pp. 294-342; Report on an Exploration of the East Coast of Hudson Bay, *ibid. for 1877-78*, pp. 1C-37C, with map, 1:253,440; Report on the Country between Lake Winnipeg and Hudson Bay, *ibid.*, pp. 1CC-31CC, with a map of the Nelson River, 1:506,880; Report on Explorations of the Churchill and Nelson Rivers, *ibid. for 1878-79*, pp. 1C-44C; Report on Hudson Bay and Some of the Lakes and Rivers Lying to the West of It, *ibid. for 1879-80*, pp. 1C-113C; Observations on the Geology, Mineralogy, Zoology, and Botany of Hudson Strait and Bay, *Annual Rept. Geol. Survey of Canada*, N. S., Vol. 1, 1885, pp. 1DD-20DD; Report of an Exploration of the Northern Side of Hudson Strait, *ibid.*, Vol. 11, 1898, pp. 1M-38M, with map of the coasts of Hudson Strait and Ungava Bay (with A. P. Low), 1:1,584,000. In the report for 1879-80 occurs a section on "The Northern Limits of the Principal Forest Trees of Canada East of the Rocky Mountains," with a map 1:5,068,800, a topic also treated in the article "The Geographical Distribution of Forest Trees in Canada," *Scott. Geogr. Mag.*, Vol. 13, 1897, pp. 281-296. A comprehensive paper on "The Labrador Peninsula" appeared in the same journal, Vol. 11, 1895, pp. 335-361. Dr. Bell's advocacy of the Hudson Bay route, based on his personal knowledge of conditions, is embodied in two papers read before the Geographical Section of the British Association for the Advancement of Science (reports, York meeting, 1881, p. 745, and Winnipeg meeting, 1909, p. 529), and in a pamphlet entitled "A New Route to Europe from the Interior of British North America," Montreal, 1881. The present consummation of this project was described by Mr. J. H. Cormie in the July number of the *Review* (pp. 26-40). Readers of Mr. F. J. Alcock's article on the Churchill River in the December, 1916, *Review*, will find pictures of the ruined Fort Prince of Wales, there described, in Dr. Bell's report for 1879-80. In 1907 Dr. Bell was awarded the Cullum Geographical Medal of this Society.

DR. ARNOLD HAGUE, the well-known geologist, died in Washington, D. C., on May 13, aged 77 years. During the early part of his career Dr. Hague was attached to the Fortieth Parallel Survey under Clarence King. With S. F. Emmons he contributed Volume 2 (Descriptive Geology, 1877) of the Final Reports. This and the accompanying volume on systematic geology by Clarence King have been referred to by De Margerie as still being the only work containing a connected discussion of Western tectonics (*Mem. Vol. Transcont. Exc. of 1912 of Amer. Geogr. Soc.*, 1915, p. 112). Other major works by Hague are: Geology of the Eureka District, Nevada, with an atlas, *U. S. Geol. Surv. Monogr.* 20, 1892, and, with others, Descriptive Geology, etc., of Yellowstone National Park, with atlas, *U. S. Geol. Surv. Monogr.* 32, Part II, 1899. A popular account appeared from his pen in 1912 (Dept. of the Interior) entitled "Geological History of the Yellowstone National Park."

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

General

MUIR, JOHN. **A thousand-mile walk to the Gulf.** Edited by W. F. Badè. xxvii and 220 pp.; map, ill., index. Houghton Mifflin Co., Boston and New York, 1916. \$2.50. 8½ x 6.

In these days when travelers are many, keen observers of nature few, and naturalists almost unknown, it is a keen delight to read and be inspired by the best that John Muir has written. A man of the wild, and yet a lover of domesticity, a philosopher who saw good in all things, with a vision beyond the ability of most men, interested in every nature story and yet primarily a botanist, John Muir gathered widely and carefully as he traveled. In the notebook paragraphs that have been edited into this very readable book, we have much of botany, more of men and places, and an occasional glimpse of a geographic observation far ahead of the times.

The South in the late sixties is presented as it was, and not as it seemed to be to an unsympathetic traveler along its railroads.

John Muir saw and appreciated, wrote down his observations and impressions, allowed himself to wander far into the unknown, earthly and spiritual, and recorded his visions. Out of his notes has been made a book that shows John Muir less mature than he is seen in his "Mountains of California," but just as appealing and inspiring. The volume is interesting and helpful. It should be in the library of every person who would like to be a naturalist if opportunity permitted. RICHARD ELWOOD DODGE.

SCHMIDT, L. B. **The economic history of American agriculture as a field for study.** *Mississippi Valley Hist. Rev.*, Vol. 3, 1916, No. 1, pp. 39-49.

A plea for more attention to agriculture in the study of American history which will be endorsed by geographers if for no other reason because agriculture is so intimately associated with geography. The author holds that the present trend of history, especially American history, "has led students to search beneath the surface of passing events and to study the . . . common everyday life of humanity . . . in its economic, social, religious, political, military, esthetic, and intellectual phases."

The majority of our people, he states, have always been engaged in agriculture, and our history from the beginning has been a story of rural communities advancing westward and developing from simple to complex stages of civilization. The interstate commerce act of 1887 and the Sherman anti-trust act of 1890 show distinct farmers' influence. The purchase of Louisiana was a direct response to the demand of agricultural interests for an outlet along the Mississippi. The close connection of cotton and slavery affected our history from the adoption of the constitution down to the Civil War. England's attitude during the Civil War was influenced by her need of cotton from the South for her mills and the need of wheat from the North to feed her people. Agriculture is passing from the extensive to the intensive state, and this transition will affect our history.

These and other cases cited all show an interplay of geographic factors. Soils, climate, topography, drainage, and other earth factors profoundly affect agriculture and, indeed, may be said to be fundamental. Although the author does not stress the geographic factors, it is clear that this trend in the study of economic history should have a geographic background. F. V. EMERSON.

— **Foreign commerce and navigation of the United States for the year ending June 30, 1915.** xlv and 928 pp. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C., 1916.

— **Prairie vegetation, some recent descriptions of.** *Journ. of Ecology*, Vol. 4, 1916, No. 1, pp. 45-54. [A review of A. G. Vestal's "Prairie Vegetation of a Mountain-Front Area in Colorado," *Botan. Gaz.*, Vol. 58, 1914, pp. 377-400, and "A Black-Soil

Prairie Station in North-eastern Illinois," *Bull. Torrey Botan. Club*, Vol. 41, 1914, pp. 351-363; R. J. Pool's "A Study of the Vegetation of the Sandhills of Nebraska," *Minnesota Botan. Studies*, Vol. 4, 1914, pp. 189-312, and "Invasion of a Prairie Grove," *Proc. Amer. Forestry Assoc.*, Vol. 10, 1915, pp. 1-8; and J. E. Weaver's "A Study of the Root-Systems of Prairie Plants in South-eastern Washington," *Plant World*, Vol. 18, 1915, pp. 227-248.]

PRATT, E. E. Our new industries: Some of the fields into which American manufacturers have been forced. Ills. *Scientific American*, Vol. 114, 1916, No. 23, pp. 586, 600-602. [Amongst the industries cited may be noted that of the dressing and dyeing of furs. The United States, the largest producer of raw sealskins, has heretofore sent the raw product to London. Even before the war endeavors were being made to establish the industry in St. Louis. The Federal Government selected this city as a market for its catch of Alaskan seal and blue and white fox furs.]

— Proceedings of the fourth American Road Congress under auspices of American Highway Association, American Automobile Association. 361 pp. Atlanta, Ga., 1914. \$1.00. 9 x 6.

QUAIFE, M. M., edit. Extracts from Capt. McKay's journal—and others. Diagr. *Proc. State Hist. Soc. of Wisconsin at its Sixty-Third Annual Meeting held October 21, 1915*, pp. 186-210. Madison, 1916. [The journal was recently discovered with that of Ordway and other Lewis and Clark records (cf. A. H. Abel: A New Lewis and Clark Map, *Geogr. Review*, Vol. 1, 1916, pp. 329-345). It was apparently drawn up expressly for the great expedition. Useful information was transcribed from the journals of McKay and his lieutenant John Evans and the transcription annotated by John Hay, a leading British fur trader of Cahokia. To it he added pertinent geographical material amassed during his own travels.]

— Quicksilver output in the United States, 1915. *Mining and Engineering World*, Vol. 44, 1916, No. 6, p. 273.

— Reclaiming swamp lands by modern methods. Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 4, pp. 44-46.

RECORD, S. J. Our present and future sources of vegetable tannins: Where the American tanner may hope to find an independent supply of raw materials. Ills. *Scientific American*, Vol. 114, 1916, No. 23, pp. 580-581 and 603-604. ["The tanners and dyers of the United States use annually about \$25,000,000 worth of vegetable tanning materials, of which nearly one-third is imported."]

REDFIELD, W. C. Remarks. [Relation of our waterways to commerce.] *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 183-190. Philadelphia, 1915.

REED, S. M. British cartography of the Mississippi Valley in the eighteenth century. *Mississippi Valley Hist. Rev.*, Vol. 2, 1915, No. 2, pp. 213-224.

REYNEN, W. B. De beetwortelsuiker-industrie in de Vereenigde Staten en hare vooruitzichten. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 5, pp. 209-221. ["The beet-sugar industry in the United States and its prospects."]

SAULSBURY, WILLARD. The strategic value of inland waterways. Map. *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 95-112. Philadelphia, 1915.

SELLS, CATO. Report of the Commissioner of Indian Affairs to the Secretary of the Interior for the fiscal year ended June 30, 1916. iii and 211 pp.; map, index. Dept. of the Interior, Washington, D. C., 1916.

— Silver production in the United States in 1915. Diagr. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 240-241.

SMITH, H. M. America's surpassing fisheries. Diagr., ills. *Natl. Geogr. Mag.*, Vol. 29, 1916, No. 6, pp. 546-583.

SMITH, J. W. National weather and crop bulletin No. 30: October, 1916. 8 pp.; maps. Weather Bureau, Washington, D. C.

SNOWDEN, THOMAS. Annual report of the Hydrographic Office for the fiscal year 1916. 32 pp. *Ann. Rept. of the Chief of the Bur. of Navigation, Appendix No. 1*. Washington, D. C., 1916.

SORRELL, L. C. Dislocations in the foreign trade of the United States resulting from the European war. Diagr. *Journ. of Polit. Econ.*, Vol. 24, 1916, No. 1, pp. 25-75.

STUDY CLUB DEPARTMENT, WISCONSIN LIBRARY COMMISSION. Present day indus-

tries in the United States. 6 pp. (Study Outline Ser.) H. W. Wilson Co., White Plains, N. Y., and New York City, 1915. 15 cents. 8 x 5.

TABER, STEPHEN. **The earthquake in the southern Appalachians, February 21, 1916.** Map. *Bull. Seismological Soc. of America*, Vol. 6, 1916, No. 4, pp. 218-226.

TALBOT, WINTHROP. **Adult illiteracy.** 90 pp.; map, diagrs. *Bur. of Education Bull.*, 1916, No. 35. Dept. of the Interior, Washington, D. C., 1916. [Distributionary study.]

TALBOT, WINTHROP. **The American illiterate.** Map, diagrs. *World's Work*, Vol. 32, 1916, No. 3, pp. 303-305. [With a map showing the states where illiteracy—due to foreign immigration—is increasing.]

— **Tin industry and consumption in 1915.** Diagrs. *Mining and Engineering World*, Vol. 44, 1916, No. 6, pp. 277-278.

TOMKINS, CALVIN. **Free ports.** *Proc. and Papers of the Fourth Ann. Convention of the Amer. Assoc. of Port Authorities*, 1915, Sept. 13-15, pp. 164-172. Los Angeles, Cal.

— **Traffic routes from the Lakes to the seaboard.** Map. *Engineering News*, Vol. 76, 1916, No. 13, Sept. 28, pp. 604-605.

— **United States Coast and Geodetic Survey, Annual report of the Superintendent, to the Secretary of Commerce, for the fiscal year ended June 30, 1916.** 164 pp.; maps, diagrs., ill., index. U. S. Coast and Geodetic Survey, Washington, D. C., 1916.

— **United States military reservations, national cemeteries, and military parks: Title, jurisdiction, etc.** Revised edit. 544 pp. War Dept., Washington, D. C., 1916.

VOGT, P. L. **The land problem and rural welfare.** *Amer. Economic Rev.*, Vol. 7, 1917, No. 1, Suppl., pp. 91-114 (discussion, pp. 102-114). [Size of holdings and relation of ownership to operation in the United States.]

WARD, R. DEC. **Immigration and the war.** *Scientific Monthly*, Vol. 2, 1916, No. 5, pp. 438-452.

WEST, H. L. **Waterways and our national security.** *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 191-196. Philadelphia, 1915.

WHITHAM, P. P. **Port terminal development: A discussion of fundamental problems.** *Proc. and Papers of the Fourth Ann. Convention of the Amer. Assoc. of Port Authorities*, 1915, Sept. 13-15, pp. 121-138. Los Angeles, Cal.

WICKS, MOYE. **Deforestation and reforestation as affecting climate, rain, and production.** 11 pp. *Texas Dept. of Agric. Bull. No. 17*, N. S. Austin [1916].

WOEHLKE, W. V. **The greatest mining boom in history.** Ill. *Amer. Review of Reviews*, Vol. 54, 1916, No. 4, pp. 429-432. [The present boom in American mining consequent on the European war.]

WOODHOUSE, HENRY. **Post Office Department invites proposals for carrying mails by aeroplane.** Map, ill. *Flying*, Vol. 5, 1916, No. 2, pp. 53-63.

— **United States, including Territories and Insular Possessions, showing the extent of public surveys; Indian, military and forest reservations; railroads, canals, National Parks and other details.** 1 in. to 37 mi. (1:2,344,320). Dept. of Interior, General Land Office, Washington, D. C., 1916. [A new edition of the general map of the United States issued by the General Land Office. It is mainly locational and administrative in character.]

SOUTH AMERICA

ECUADOR, PERU, BOLIVIA

GONZÁLEZ PALENCIA, C. A. **Descripción geográfica de la Real Audiencia de Quito que escribió Dionisio de Alsedo y Herrera.** xxxv and 101 pp., map, index. Publication of The Hispanic Society of America. Imprenta de Fortanet, Madrid, 1915. 10½ x 7½.

Long years of intelligent and devoted service in colonial Spain confer a high value on Alsedo's contributions to the literature of the Indies. His earlier works, the "Memorial Informativo del Comercio del Perú" and the "Aviso Histórico," show a keen appreciation of the dangers threatening the colonies in the first half of the eighteenth century. He fully realized the menace of the Dutch and English and especially the

encroachments of the latter since the grant of the Asiento of 1713. The special knowledge he held led to his appointment as President, Governor and Captain-General of Tierra Firme during a period of English aggression in Panama. He had also been active while President of Quito in repelling Portuguese advances up the Napo. His jealous care had even been carried so far as to endeavor to limit the investigations of the expedition despatched by the French Academy of Sciences to Ecuador for the measurement of an arc of the meridian. He opposed, as he himself expressed it, the projects "poner los ojos en la tierra," though his more tolerant successor permitted the construction of maps and plans. Whilst his career in the Indies terminated in the common fashion with impeachment he was honorably acquitted. His succeeding retirement in Spain afforded him the opportunity of writing (1766) the *Descripción Geográfica*, a work for which he was specially qualified by experience gained during office as President of the Audiencia.

This work has heretofore been known only from two manuscript copies existing in the National Library of Madrid. It is now published, annotated and with a prefatory biography of the writer. Alsedo's text commences with a description of the city of Quito, "the evergreen," and subsequently takes up the component provinces of the Audiencia, concluding with a short report on the Marañon and Amazonas accompanied by the map of Padre Samuel Fritz published in Quito 1707. Of the entire work perhaps the most particular interest attaches to the chapter on the roads leading to Quito. It is a graphic account of the immense difficulties of communication that isolated Quito until the coming of the railroad. Orton, writing of Quito in 1868 and emphasizing the lack of transportation facilities, remarked: "There are not six carts in Quito. If you wish to move you must coax a dozen Indians, who care little for your money or your threats. Carriages—antique vehicles, of which there are two or three in the city—are drawn by mules. The first was introduced . . . so late as 1859" (Orton: *The Andes and the Amazon*, New York, 1876.) The editor of the *Descripción* claims, with justification, that it is the best description of Quito written up to its own date. It is, however, singular that whilst referring to the description of Quijos by the Conde de Lemos (1608) and to other later works he should entirely overlook the valuable material on the Audiencia of Quito contained in the "Relaciones Geográficas de Indias" (Madrid, 1881-97). The third value of that notable collection includes several official reports of the province of Quito and its chief cities written in the last half of the sixteenth century, as, for example, the "Relación de la Provincia de Quito y Distrito de su Audiencia por los Oficiales de la Real Hacienda," dated 1576.

EUROPE

THE LOW COUNTRIES, LUXEMBURG

BAREN, J. VAN. *Oudere en jongere Löss in Nederland*. Ills. *Tijdschr. Kon. Nederl. Aardrijks. Genoot.*, Vol. 33, 1916, No. 2, pp. 201-205.

BIJLSMA, D. *De zuidnederlandsche immigranten en de textielindustrie in oud-Rotterdam*. *Vragen van den Dag*, Vol. 31, 1916, No. 11, pp. 858-867. Amsterdam.

BLINK, H. *De loop van den Nederlandschen handel en van de handelsbetrekkingen van Nederland met de belangrijkste landen sedert 1847*. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 1, pp. 27-37; No. 2, pp. 49-64; No. 3, pp. 107-117; No. 4, pp. 157-160.

BLINK, H. *Economische geographie der Provincie Overijsel*. Maps. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 3, pp. 117-128; No. 8, pp. 395-404; *De economische ontwikkeling van Overijsel in de laatste eeuw*, No. 9, pp. 427-441; *Ontwikkeling der nederzettingen in Overijsel als economische centra*, No. 10, pp. 478-490.

BLINK, H. *Het hoogheemraadschap Waterland in zijn opkomst, strijd tegen het water en tegenwoordigen toestand*. Map. *Vragen van den Dag*, Vol. 31, 1916, No. 4, pp. 278-297. Amsterdam. [On the district of Waterland on the Zuider Zee near Amsterdam and its perennial conflict against the encroachment of the sea.]

BLINK, H. *Nederland als tuinbouwland*. *Historisch en economisch-geographisch beschreven*. Maps, diagrs., ill. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 6, pp. 229-362.

BLINK, H. *Ontwikkeling van de economische toestanden in Nederland en zijn betrekkingen met de nabuurlanden gedurende de laatste eeuw*. *Tijdschr. voor Econ. Geogr.*, Vol. 5, 1914, No. 9, pp. 345-353; No. 10, pp. 369-384; No. 11, pp. 416-434; Vol. 6, 1915, No. 7, pp. 266-276; No. 8, pp. 289-299; No. 9, pp. 329-344.

DUBOIS, EUG. *Hollands duin als natuurlijke zeevering en de tijd.* *Tijdschr. Kon. Nederl. Aardrijks. Genoot.*, Vol. 33, 1916, No. 3a, pp. 395-415.

FOUCHIER, C. AND L. DE. *Au pays hollandais.* 228 pp.; map, ills. Hachette et Cie., Paris, 1913. Fr. 4. 7½ x 5.

GUÉNOT, M. S. *La Belgique pittoresque et les villes martyres: La cité de Gand en 1912; la Belgique terre d'expériences sociales.* *Bull. Soc. de Géogr. de Toulouse*, Vol. 34, 1915, No. 3-4, pp. 212-223.

KIEHL, W. J. L. *Holland in the grip of its old enemy.* Ills. *Scientific American*, Vol. 114, 1916, March 4, pp. 235 and 264. [The storms of Dec. 1915-Jan. 1916 caused undoubtedly the worst flood disaster in Holland since 1825 and in some respects the worst since the famous fifteenth century catastrophe. The waters covered an area of 37,000 acres and have impregnated the land with salt (cf. daily *Commerce Reports*, 1916, No. 42, Washington).]

SCANDINAVIA, INCLUDING FINLAND

SANDSTRÖM, J. W. *Über die Ablenkung des Windes infolge der Erddrehung und der Reibung.* Map, diagrs. *Arkiv för Matematik, Astronomi, och Fysik*, Vol. 9, No. 31, pp. 1-8. Upsala, 1914.

In this paper the author considers an interesting case of frequent left-handed deflection of the wind from the pressure-gradient during the winter on the western slope of the Scandinavian mountains. It appears that there is a well-marked "aspiration" of air towards the Atlantic Gulf Stream area, evidenced by prevailing easterly winds on the western side of the highland. The cold air becomes more or less stagnant, i. e., is blocked, on the eastern side of the divide, and then comes down on the western slopes almost like a waterfall. Near the surface this off-shore air movement is greatly retarded by friction, whereas the upper air moves northwestward at high velocities almost independently of friction. The right-handed deflective force of the earth's rotation, which is proportional to the velocity, is far more effective in the case of the upper than in that of the lower currents. The local topography is very marked, with a system of deep valleys leading from the mountain ridge to the ocean. In each valley the upper air, moving northwest, exerts a strong pressure towards the *right* sides of the valleys. The pressure thus becomes higher here than along the left-hand side of the valley at the same level. This pressure-gradient to the left acts upon the lower air, which is moving at a much slower velocity, and as this same lower air is but slightly affected by the earth's rotation, the result is a left-handed deflection. It is, of course, these lower currents whose direction is shown by the local wind vanes.

R. DEC. WARD.

SPAIN, PORTUGAL

BECKER, JERÓNIMO. *El medio geográfico en la historia de España.* *Bol. Real Soc. Geogr.*, Vol. 58, 1916, Part 3, pp. 257-279. Madrid.

CARANDELL, JUAN. *Las calizas cristalinas del Guadarrama.* 69 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 8.* Madrid, 1914.

— *Crónica geográfica.* *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 8-9, pp. 358-363. Real Soc. Geogr., Madrid. [Giving the distribution by provinces of the calculated population of Spain of 20,630,910.]

DARDER PERICÁS, BARTOLOMÉ. *Estratigrafía de la Sierra de Levante de Mallorca (Región de Felanitx).* 41 pp.; map, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 10.* Madrid, 1915.

FURLONG, C. W. *On the crest of the lost Atlantis.* Map, ills. *Harper's Mag.*, No. 801, Vol. 134, 1917, pp. 331-342. [The Azores.]

GIL, P. M. *Memoria anual del cónsul de Chile en Logroño correspondiente al año 1915.* *Bol. de Relaciones Exteriores*, No. 65, 1916, April and May, pp. 33-40. Santiago de Chile.

GÓMEZ DE LIARENA, JOAQUÍN. *Bosquejo geográfico-geológico de los Montes de Toledo.* 74 pp.; maps, diagrs., ills. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 15.* Madrid, 1916.

HERNÁNDEZ-PACHECO, EDUARDO. *Las tierras negras del extremo sur de España y sus yacimientos paleolíticos.* Map, ills. *Trabajos del Museo Nacl. de Ciencias Nat.,*

Ser. Geol. No. 13, pp. 3-26. Madrid, 1915. [Abstracted in the December, 1916, *Review*, Vol. 2, pp. 468-469.]

— **Industrie espagnole, L', et la guerre; Sabadell et l'industrie textile.** Ills. *La Nature*, No. 2222, 1916, April 29, pp. 278-282. [Sabadell is a textile manufacturing town near Barcelona.]

— **Información geográfico-comercial: La producción española en los mercados extranjeros según el Centro de Información Comercial del Ministerio de Estado.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 1-2, pp. 22-43. Real Soc. Geogr., Madrid.

KNOBLAUCH-COTTENET, MAX. **L'industrie espagnole et la guerre: Les richesses minières et métallurgiques de l'Espagne. Le Creusot espagnol: Altos Hornos de Vizcaya.** Ills. *La Nature*, No. 2240, 1916, September 2, pp. 150-155.

M——, L. **La popolazione e le risorse economiche del Portogallo.** *L'Esplorazione Commerciale*, Vol. 31, 1916, No. 8, pp. 307-311.

MOYE, M. **Le réseau pluviométrique de l'Espagne orientale.** *Bull. Soc. Linguistique de Géogr.*, Vol. 38, 1915, No. 4, pp. 260-264.

NAVARRO, L. F. **Monografía geológica del Valle de Lozoya.** 100 pp.; map, diagrs., ill. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 12.* Madrid, 1915.

— **Nomenclatura geográfica de España, Reforma de la.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1916, No. 6-7, pp. 209-244. Real Soc. Geogr., Madrid.

OBERMAIER, HUGO. **Estudio de los glaciares de los Picos de Europa.** 41 pp.; maps, diagrs., ill. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 9.* Madrid, 1914. [For a note on a related paper by this author and the joint authors of the following two papers, see "The Quaternary Snowline in the Iberian Peninsula," *Geogr. Rev.*, Vol. 2, 1916, p. 308.]

OBERMAIER, HUGO, AND JUAN CARANDELL. **Contribución al estudio del glaciario cuaternario de la Sierra de Gredos.** 55 pp.; maps, diagrs., ill. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 14.* Madrid, 1916.

OBERMAIER, HUGO, AND JUAN CARANDELL. **Los glaciares cuaternarios de Sierra Nevada.** 87 pp.; map, diagrs., ill. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 17.* Madrid, 1916.

PRÆSENT, HANS. **Bau und Boden der Balearischen Inseln: Beiträge zur Landeskunde der Inselgruppe.** Map, diagrs., ill., bibliogr. *Jahresbericht der Geogr. Gesell. zu Greifswald*, Vol. 13, 1911-12, pp. 21-106. Greifswald, 1913.

QUIRÓS, C. B. DE, AND JUAN CARANDELL. **Guadarrama.** 47 pp.; maps, diagrs., ill. *Trabajos del Museo Nacl. de Ciencias Nat., Ser. Geol. No. 11.* Madrid, 1915.

ROUSE, H. E. **Memoria del cónsul de Chile en Bilbao correspondiente al año próximo pasado.** *Bol. de Relaciones Exteriores*, No. 65, 1916, April and May, pp. 40-49. Santiago de Chile.

WAGNER, HERMANN. **Edw. Wrights Seekarte für die Azorenfahrt vom Jahre 1599.** Map. *Petermanns Mitt.*, Vol. 61, 1915, No. 12, pp. 476-479.

ASIA

TURKEY IN ASIA, ARABIA, CAUCASIA, IRAN

GIBBONS, H. A. **The foundation of the Ottoman Empire.** 379 pp.; maps, bibliogr., index. The Century Company, New York, 1916. 9 x 6.

Dr. Gibbons' name has in recent years been associated with the history of the Osmanli Turks. In this volume he presents an account of the rise to power of that branch of the Turkish people which has affected the fate of the western world. Fundamentally the work is a phase of the history of Asia Minor. The emirates, which came to be grouped together under the name of Ottoman Empire, were founded on this Asiatic peninsula. In the fascinating study of the evolution and consolidation of these petty states the author brings no addition to their history, but he has the great advantage of being able to probe somewhat deeper than the average historian into the past life of the Osmanlis because of his residence in their country. His insight therefore guides his reader to a better understanding of the important changes set forth in the book.

These changes are known to every student of Turkish history. Few, however, could give such an excellent description of the military establishment of the early sultans as that presented by Dr. Gibbons. When we think that all the achievement which the Turks can ever boast of as a people rests on their efficiency as fighters, the importance of the topic is readily understood. For the arts of peace or western civilization they cared but little. But, as the author shows, they were practical enough to adopt European methods in tactics and military organization. Anyone familiar with contemporary Turkey can say as much of the Turks today.

The minute research required in the preparation of this work has brought in evidence the extent of the intercourse between the Ottomans and western Europe prior to the fall of Constantinople. This means much at present, when every great European nation is being drawn towards Turkish lands. The events which are now unfolding themselves on Europe's eastern battlefronts provide a climax to activity which can be traced as far back as the first years of the period covered by the author. This historical continuity applies as well to western Asia. Hence to begin the book by stating that a new race appears in history is to overlook the share of the desert-bred Turk in shaping the destiny of Asiatic humanity, which has always exerted its influence on the western world. The Osmanlis had merely advanced farther west than the Mongols or Tatars.

The transliteration of Asiatic names shows once more the great need of a systematic English spelling of eastern geographical and historical names. Dr. Gibbons does not seem to be familiar with the Royal Geographical Society's system.

MOUTRAN, NADRA. *La Syrie de demain*. viii and 462 pp.; maps, diagr. Plon-Nourrit et Cie., Paris, 1916. 6 fr. 8 x 5.

Syria since the days of Phœnician navigators and up to the Turkish conquest enjoyed an uninterrupted intercourse of trade with southern Europe. Out of these historical beginnings arose the problems discussed in this book. The author devotes considerable space to the natural resources of the country and shows that their development during the past half-century received its strongest impetus from French sources. As he was born and bred in the midst of Syria's motley population, his descriptions of the inhabitants have all the flavor of intimate knowledge. Syria, like Mesopotamia, is one of western Asia's corridors and a great meeting-land of men of the Alpine and Mediterranean races, that is, of highlanders and lowlanders. The Syrians, described under various names, are products of this mingling and consist of peoples well known for their lack of union.

In treating of Syria's status after the war, the author advocates the creation of a unit which will extend from the Gulf of Alexandretta to the Egyptian boundary. Like all Syrians he is in favor of strengthening the ties that bind France and his native land. To those who would see Palestine incorporated with Egypt he shows that, geographically, Palestine is the natural termination of the Syrian regional unit, and that the stretch of desert between Gaza and the Nile has been an obstacle to intercourse since early historical times.

CHINA

BISSOLI, LUIGI. *Notizie di geografia commerciale sulla Cina*. *L'Esplorazione Commerc.*, Vol. 31, 1916, No. 6, pp. 225-235.

DE MOIDREY, J. *Meteorological observations at Lu-Kia-Pang, China, for 1914*. *Symons's Meteorol. Mag.*, No. 603, Vol. 51, 1916, April, pp. 33-36; No. 604, May, pp. 53-55.

FISHER, W. K. *The oldest place of worship in the world*. Ills. *Scientific Monthly*, Vol. 2, 1916, No. 6, pp. 521-535. [Tai Shan, in Shantung province, China.]

MEAD, D. W. *Floods and famine in China*. *Journ. of Geogr.*, Vol. 14, 1916, No. 7, pp. 261-264. ["Reprinted from the *Wisconsin Alumni Magazine*, June, 1915."]

— *Note sur les travaux topographiques de la mission Voisins-Segalen-Lartigue dans la Chine occidentale, 1914*. Map. *La Géogr.*, Vol. 30, 1914-15, No. 4, pp. 308-311. Paris.

ROSBY, P. M. *Wu-Han: The heart of China*. Maps, ills. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 6, pp. 266-279.

TING, V. K. *The coal resources of China*. Map, ills. *Far Eastern Rev.*, Vol. 13, 1916, No. 1, pp. 1-4. Shanghai.

VAN DER VEEN, H. *The South Grand Canal conservancy scheme*. Ills. *Far Eastern Rev.*, Vol. 12, 1916, No. 9, pp. 333-338.

— **China—East Coast: The Brothers to Ockseu Island, including the west coast of Formosa from Onkan bank to Kukan road.** 1:300,000. *U. S. Hydrogr. Office Chart No. 3177.* Washington, D. C., 1916.

— **China—Southeast Coast: Kwangchow Bay and River Matshe.** 1:40,000. *U. S. Hydrogr. Office Chart No. 3169.* Washington, D. C., 1916.

— **Hainan Strait.** 1:150,000. *U. S. Hydrogr. Office Chart No. 3164.* Washington, D. C., 1916.

ROUX, FRANÇOIS. **Se-Tch'ouan occidental.** 1 in. to 12 mi. (1:760,320). Inset: Province du Se-Tch'ouan. Mission Catholique, Shanghai, 1910.

— **Tchen Tou, Plaine de, près Shanghai.** 1:200,000. Mission Catholique, Shanghai, [1910].

— **Tonkin Gulf.** 1:700,000. *U. S. Hydrogr. Office Chart No. 3153.* Washington, D. C., 1916.

— **Tonkin Gulf, Approaches to Haifong.** 1:72,000. *U. S. Hydrogr. Office Chart No. 3161.* Washington, D. C., 1916.

— **Yang-Tse-Kiang, Bassin inférieur du.** 1:1,000,000. Service Géogr. de l'Armée, Paris, [1913].

— **Yangtze River: Shanghai to Nanking.** 1:150,000. *U. S. Hydrogr. Office Chart No. 3182.* Washington, D. C., 1916.

— **Yangtze River: Tunglin to Hankow.** 1:73,000. *U. S. Hydrogr. Office Chart No. 3185.* Washington, D. C., 1916.

INDIA

BAKER, H. D., AND OTHERS. **British India, with notes on Ceylon, Afghanistan, and Tibet.** 638 pp.; map, diagrs., ills. *Special Consular Rept. No. 72.* Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, 1915. 9½ x 6.

The material for this report was gathered by Consul Henry D. Baker and it presents comprehensive facts concerning our markets in India. The report has some clear, explanatory accounts of trade and industrial conditions of value to the commercial traveler seeking new fields. The importance of geographical influences in trade relations is frequently emphasized, as in the following extracts relating to the monsoons:

"The (rainy) monsoon is to India what the Nile is to Egypt in the general prosperity of the country. The monsoon has such an important effect on the general trade that there is a reluctance to enter into business engagements until it is known whether the monsoon is a success or a failure. Commercial travelers then will find their customers in a more definite frame of mind regarding the purchase of goods at the end of the monsoon in September and October. The alternate excess of humidity and then dryness, together with the great heat of moist districts, requires considerable consideration as regarding packing of goods and the materials employed in manufacturing. Iron and steel rust rapidly under these conditions; leather goods become covered with mold; furniture warps and most provisions have to be sealed in tins."

The excessive heat of India requires air-cooling devices. The ancient punkah-wallah has been replaced to a slight extent by electric fans, Calcutta alone having 40,000 fans in use. There is an increasing market for the American makes. Waterpower development has made electricity cheap in some regions, for instance in Simla, the summer capital of India, it is cheaper than kerosene. The electric angethi is replacing the charcoal heater. American electrical equipment has been utilized in many of the hydro-electric plants.

Some of the states of India are under the control of native princes whose authority is absolute. The State of Hyderabad is about the area of New York and Massachusetts, with a population of thirteen millions. His Highness the Nezam of Hyderabad has a personal income of over two million dollars and his palaces have all of the most modern devices for convenience and comfort. About four hundred motor cars are owned by His Highness for the use of his guests and the ladies of the royal zenana. The Maharaja of Mysore uses electric lights of American manufacture, telephones made in Chicago, motor cars from Cleveland and a large pipe organ from Salem, Ohio.

The report is valuable to export houses, and its clear statements regarding trade conditions should be followed by the commercial traveler who seeks to develop business in India. The map accompanying the report, one of the regular stock of wax-engraved maps sold by a commercial firm, falls far short of the standards we have become accustomed to expect in a government document.

W. M. GREGORY.

The preceding review may be supplemented by a word on some striking effects of the monsoon in India on commercial conditions in New York. The cocoa nut is an important product of southern India: it is indeed the chief commercial crop of the Malabar coast. The annual harvest is estimated at some 1,000 million nuts and the copra of Cochin commands the highest price in the world market. Export of the product is largely regulated by climatic conditions. During July and August the summer (southwest) monsoon attains its maximum force and raises high seas along the peninsula coasts. Similarly the winter monsoon, comparatively light in the head of the Bay of Bengal, blows strongly along the Coromandel coast up to January (H. F. Blanford: *The Climates and Weather of India, Ceylon, and Burmah*, London, 1889). At these two seasons when the always heavy surf is augmented shipping is greatly delayed. Cargoes dependent upon lighterage are deferred until the subsidence of the winds. Thus cocoanut oil and copra accumulate in quantities and the supply often runs short in the United States. Some traders therefore arrange for increased shipments just before the heavy winds begin and on the last boats to leave the exposed coasts. The result is that they control the New York market, which means, in the case of these products, they control the market throughout the country.

— **Annual reports of parties and officers, 1913-14.** x and 180 pp.; maps, diags., ills., bibliogr. *Records of Survey of India*, Vol. 7. Calcutta, 1916.

— **Annual reports of parties and officers, 1914-15.** 176 and ix pp.; maps, ills. *Records of Survey of India*, Vol. 9. Calcutta, 1916.

BARNARD, A. S. **Glimpses of Ceylon.** Ills. *Journ. Manchester Geogr. Soc.*, Vol. 31, 1915, Parts I-IV, pp. 36-51. [An address delivered to the Manchester Geographical Society on November 23rd, 1915.]

BURRARD, SIDNEY. **The plains of northern India, and their relationship to the Himalaya Mountains.** *Records of Survey of India*, 1914-15. Vol. 9, pp. 149-163. Calcutta, 1916.

HAYDEN, H. H. **The mineral production of India during 1915.** *Records of Geol. Survey of India*, Vol. 47, 1916, Part III, pp. 144-195. Calcutta.

HUMAN GEOGRAPHY

ANTHROPOLOGY AND ETHNOLOGY

BERRY, E. W. **The environment of the ape man.** Maps, ill. *Scientific Monthly* Vol. 3, 1916, No. 2, pp. 161-169.

The ape man referred to by Professor Berry is the Pithecanthropus, or Trinil man of Java, discovered in 1891. The scanty remains of this man have been the theme of endless controversy and literature, but the final verdict is very much in accordance with the views of the discoverer, Dubois, although the period of their deposition is now considered early Pleistocene and not, as first believed by him, Pliocene.

The paper deals with the plant life associated with the skeletal remains and the accompanying fauna, both vertebrate and invertebrate. The author assigns the date of the beds in which the remains were found to Günz (first) or Mindel (second) glaciation (in Europe), following Penck and Osborn in this correlation, but doubting the antiquity (500,000 years) ascribed by them to this period. Both the flora and the fauna are clearly of northwestern origin, that is from India and Indo-China, and Pithecanthropus very probably represents an outlying member of the group of the most primitive men scarcely evolved from the ancestral anthropoid stem—in fact, an intermediate type. As the author states, there is no reason to assume that he stood in direct ancestral relation to the Neanderthal or the Neanderthaloid Heidelberg man.

Man most likely became man in Central Asia during the warm and moist Pliocene, and his evolution there was greatly accelerated by the advancing cold of the oncoming Glacial Period. This cold naturally destroyed the forest and with it the food supply, forcing the proto-human ape not only to abandon his refuge in the trees but to change his habits and become definitely carnivorous. Man from that early time, the beginning of the Pleistocene down to the opening of the Neolithic, about 12,000 years ago, remained purely carnivorous, and some living tribes, such as the Eskimos, still remain so. With this change from a partly arboreal habitat and frugivorous diet to life on the ground as a predatory meat-eating animal, came the association in hunting packs or groups and the need of weapons and tools. Along with the newly acquired freedom from locomo-

tion of his hands, the opposable thumb developed, and the ape man started on his evolutionary road to full humanity. This road led to a large extent through the extermination of the larger mammals, at first his dangerous enemies and later his legitimate prey.

The instincts of hunting and killing, which in the early days of man's supremacy destroyed many species of rival mammals, were finally turned against rival tribes and remain well developed to this day. At each stage of this early evolution, which it is safe to assume was in Asia, the most advanced group spread widely and killed off or absorbed its less progressive neighbors, except such as had found an isolated refuge. In outlying countries or islands these less developed types may have lingered long unchanged, and Pithecanthropus may have been a representative of such antiquated remnants surviving in Java, while in the ancestral broadland in Central Asia the rigorous selection due to the changing climate and advancing glaciers compelled an accelerated evolution in the original stock from which the forebears of Pithecanthropus sprang. In short, the finding of Pithecanthropus in a remote corner of the Holarctic region does not preclude the possibility of the contemporary existence of more developed types in the geographical center of radiation of the human family.

Professor Berry's paper is an illuminating and fascinating study of the life surroundings of the earliest ape man of which we have as yet definite knowledge. It is this kind of intensive study that is laying sure foundations for our knowledge of the surroundings of the Men of the Dawn.

MADISON GRANT.

EDUCATIONAL GEOGRAPHY

DRYER, C. R. **Elementary economic geography.** 415 pp.; maps, diagrs., ills., index. American Book Co., New York, Cincinnati, and Chicago, 1916. \$1.28. 8 x 5½.

Geography can be taught effectually only as essential features are emphasized and as less important facts are disregarded. This work recognizes this principle to a greater extent, perhaps, than any other textbook of geography. It does not attempt to cover the whole world, nor does it attempt to treat all the minor industries of the United States, with which country it primarily deals.

The first of the two parts into which the book is divided has for its purpose the teaching of the fundamentals of economic geography. This is done (1) by a series of descriptive illustrations showing the dependence of primitive peoples upon their environment, (2) by a suggested study of the economies of the home region, and (3) by a brief statement of the principles underlying the organization of complex economic societies.

The second part of the book deals with the economic geography of the United States. For the purpose of this study the United States is divided into five industrial or economic regions, which necessarily bear a close relation to the natural regions of the country. Each economic region is treated from the standpoint of the chief occupations of that region with the view of showing how the people obtain a living.

Much may be said in commendation of the book. The division of the United States is sufficiently simple to be readily comprehended and appreciated by pupils of the grades, for which the book is intended. The division on the basis of great industries will doubtless appeal to pupils more readily than division into natural regions, or the arbitrary grouping of states which is found in most books. Quite as important as the manner of division of the country is the strong association made between each region and its chief activities. For instance, the Eastern States stand first of all for manufacturing, the Southern States for agriculture, and so on. This treatment suggests one of the best solutions of the problem of minimum essentials. Even more striking than the statement and classification of facts is the emphasis laid upon principles of geography. Principles are frequently stated and are constantly suggested. Indeed, few facts are given which do not have some bearing upon significant generalizations. While the book deals essentially with the United States, brief reference is made, in the treatment of every region and in the discussion of almost every industry, to conditions in other parts of the world. Thus, to the pupil, the United States is not an isolated region. In comparison with the rest of the world its similarities, differences, and relations are constantly shown.

With all its good qualities the book must be used with some caution. Not a few terms and expressions are beyond the comprehension of pupils of junior high school age. Moreover, principles and generalizations are sometimes stated without sufficient illustration to make them understood by the average pupil. These features of the book, however, should present no great difficulty to the experienced teacher who constantly keeps in touch with the attainments and capabilities of her pupils.

LEONARD O. PACKARD.

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BETWEEN THE TIGRIS AND THE INDUS*

By COLONEL SIR THOMAS H. HOLDICH

Former Surveyor General of India

On the British Indian frontier, some two hundred miles to the west of Peshawur, there is an upland of open rolling plains, intersected and encompassed by rugged mountains, well watered and fertile, enjoying, on the whole, a temperate climate, bright and warm with sunshine in summer and wrapt in the snowy mantle of an Eastern Switzerland in winter. It is, indeed, a Land of Promise. I know nothing more beautiful than the promise of late spring in this land. Then the wide plains are spread with a shimmering sea of upspringing corn, and at the far edges of the plains the lower slopes of the mountains are half veiled in a light-blue haze which faintly reveals white villages clinging to their craggy spurs. Near by, the running streams of bronze irrigation water, bordered by groves of mulberry and scented willow, are often pink with the scattered petals of peach and almond blossom. It is a land of the vine and the olive and the melon, and of a great wealth of later autumn fruits. In winter it is icebound, with much display of the fantastic beauty of ice shapes in waterfall and river fashioned by the frost grip under the shadow of the snow-capped hills which stand round about its outspread capital; but the winter is the winter of Switzerland.

Apart from its academic interest, it is a subject of vital importance to us at the present time to know what lies between the Tigris and the Indian frontier, for events are gradually shaping themselves there which may ultimately affect our own destinies profoundly. We know that for centuries, since the Turk and the Mongol blocked the way to overland commerce between the Far East and the West, commerce has been forced, so to speak, into the sea. There was a time when, across the width of Persia, by at least

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two world-old highroads, the slow caravans passed and repassed, wearing deep ruts where the camels trod, bringing silks and spices and merchandise from Central Asia and India to Syria and the West. Then came the sweeping hordes of the northeast to interpose a barbaric wedge, which practically shut the main gates of the Eastern trade. European ships then began to find their way to India and China, and one by one, as rival competitors for the seaborne trade sprang into existence, success in securing the greater portion of that trade carried them to the foremost position in wealth and power in the Western world. Finally, England secured it, and has practically held it for two centuries, with what results we know. Let it never be forgotten what England owes to her trade with India. It was the very foundation of her greatness as a sea power.

Now, once again, does there appear to be in a not very remote future the chance of a revival of that old world-honored overland trade which existed before the days of Israel, which brought the treasures of the East to the marts of the West. There is abundant evidence before us that this desire of the nations—the acquisition of the highway to the East—is again a powerful force in international politics. Who can very well doubt that the center of conflicting interest in the present war is gradually shifting eastward and trending towards Constantinople (with all it stands for in the Mediterranean, in Egypt, in Asia Minor, Mesopotamia, and ultimately in Persia), as the final issue to be fought to a finish between Germany and Russia? Two notable events have lately been recorded in the progress of Eastern affairs which bear directly on this important question of overland communications—they are signs of the times and portents of the future. The first railway has been opened in Persia. For the first time has the blue-coated agriculturist of northern Persia stared open-mouthed at a locomotive, bearing a huge national emblem, traversing his fields. This is the Russian military line which connects Batum on the Black Sea with Tabriz. The other event is the piercing of the Taurus tunnel by the Germans, which will rapidly bring Constantinople and Bagdad into direct communication by rail and place a rival enterprise on the Mesopotamian field.

From Herat I once traveled eastward through Afghan Turkestan to the plains south of the Oxus on the borders of Badakshan, in the midst of which plains stands the ancient capital of the Greek province of Bactria, now called Balkh. The modern town is founded on deep buried masses of ancient ruins, about which it is difficult to obtain any authentic information locally. Ask any educated Afghan of that part of the world to tell you the tale of Balkh, and he will reply that it is the “mother of all cities,” older even than the ancient Nineveh, and that its birth story is lost in those traditional mists which ascribe both Balkh and Nineveh to Nimrod as their founder.

As we are now dealing with a region where geographical disposition of mountain and plain has shaped the destinies of nations from the very

earliest dawn of history, and as the same geographical factors will yet again shape the course of a history as yet unwritten, it may be interesting to refer briefly to their chief characteristics.

The great plateau of Persia, overlooking Mesopotamia across rugged bands of Kurdish mountains on the west, is shut off from the steppes and highlands of the north by a continuous series of mountain systems, which stretch from Armenia to Afghanistan and beyond through the heart of Asia. But this mountain rim is for a great part of it narrow and easily passable, bordered on the Persian side by a continuous edge of grassland, through which runs the much traversed road connecting Teheran with Meshed and Afghanistan. There are important commercial towns along this route, but the value of it is largely discounted by the fact that the nomads of the steppes north of the mountains still carry their raiding enterprises (*alamans*) over the hills and into this grassland. South of the strip of cultivable country lie the great central salt deserts, separating it from the next important route traversing Persia from west to east, which starts from Bagdad, follows the old Median Way to Kermanshah, and then passes by Kirman to the Indian frontier. These are the two great important highways between Mesopotamia and India which are bound, both of them, to become something more than mere geographical features in a not very remote future. To the north of that mountain barrier, and extending eastward and northward farther than we can tell, in the early dawn of history there dwelt scattered clans of a vast Asiatic horde—Scythians and Sarmatians, of whom we have but a shadowy record. We know, however, that about the period of the Israelite captivity they were crossing the Don, already pushing their way westward towards Europe. I have more to say about them presently.

The geographical position of Nineveh also demands a short examination. South and east of Nineveh, hedging in the plains of Mesopotamia, are bands of wild mountain ranges, rank upon rank, forming a revetment to the Persian plateau, which are extended parallel to and facing the Persian Gulf and Arabian Sea to the Indus basin. They are full of uncouth and unconquered highlanders of many clans and various derivation, some of whom retain the names given them in the records of Herodotus, who wrote five centuries before our era and about two and a half centuries after the fall of Samaria. Immediately north of Nineveh, where rise the sources of the Tigris and the Euphrates, are the mountains of Armenia, reaching to the southern shores of the Black Sea. Through these hills eastward and northward lie those difficult routes, once open to Greece and Assyria, which now, in the process of historical evolution, are again open to military movement. The road from the north, dominated by Bitlis, and the road from the east, dominated by Kermanshah, which have both been in Russian hands, converge on Nineveh—or rather on Mosul, which is the modern representative of that ancient capital, and which is the chief center of

Turkish military activity in Mesopotamia. Thus once again does Nineveh assert the importance of her geographical site as one of the gates to Mesopotamia.

To turn now to this high rolling land of which I spoke in the beginning. This is the home of the Ben-i-Israel (i. e. sons of Israel). The capital town, crescent-shaped and hill-protected, is Kabul; and the country about it is the upper Kabul River basin, a part (and perhaps the most important part) of Afghanistan. The name Afghanistan arouses many memories in many of us; one unfailing point of interest in connection with it is its origin. Afghanistan means, of course, no more than the home of the Afghan; but who is the Afghan, and where does he come from? The name has become crystallized now in Indian history and Indian frontier records for nearly two centuries, but it is apparently only as old as the days of the founder of the Durani dynasty, Ahmad Shah, and it is not a name, so far as I know, acknowledged by any one of the extraordinarily mixed nationalities that occupy Afghanistan. There are Turks and Tajiks, Arabs, Persians and Mongols, with Pathans of mixed origin and all of very ancient lineage, and there are the Ben-i-Israel—but no specific Afghan. I know no one from the mountains of Kafirstan to the deserts of Baluchistan who calls himself Afghan. It is, however, just as well that we should have a recognized British official term for all the peoples governed from the Kabul center of administration within the boundaries fixed to the Amir's dominions, and the name Afghan is far too useful to quarrel with.

The Ben-i-Israel belong to (if they do not comprise) those Durani clans who established themselves as the dominant power in Afghanistan after the death of the great Persian ruler and robber, Nadir Shah, in the eighteenth century, and, consequently, the Amir of Afghanistan is their ruler and chief. They spread over a great part of the upper basin of the Kabul River, and are to be found on both sides of the Hindu-Kush as well as in the basin of the Swat River, where they are known as Yusufzais. In the absence of anything approaching to reliable statistics I will not venture to give an estimate of their numbers, but, at a rough guess, I should put them at about one-fourth or one-fifth of the entire population of all that we call Afghanistan.

Certain ethnological and philological facts point to their Israelitic origin. The statement that the captive Israelites were transported from Syria to regions beyond the Euphrates is vague. Nineveh itself is beyond the Euphrates; together with all the valleys of the upper Tigris and Armenia and Lake Van, Erzerum and Bitlis are all beyond the Euphrates so far as Syria is concerned—but Armenia is the country for which there is historical authority for locating them. This, however, is comparatively unimportant if we consider the statement of Josephus that seven centuries and a half later they were still a "great multitude" gathered beyond the Euphrates. So that it is only within the last eighteen centuries that they have become

so scattered and absorbed by other tribes and races as to leave no trace of national existence. But doubtless the true Semitic spirit of the nomad possessed them and, like the Jews, they probably spread in small groups right through Asia. There is every reason to suppose that they did so. Unlike the Jews, they sacrificed their national cohesion to the lost faith of their forefathers, which had weakened long before they left Samaria. The rites and ceremonies of Jewish ritual, which are still so powerful a factor in maintaining the national unity of the Jews, had given place to strange forms of worship with a general tendency towards idolatry, nor was that federation of tribes which formed the Kingdom of Israel free from constant internal strife and disturbance. Thus elements of disintegration were deeply rooted among them.

There appears to be some confusion of thought as to the identity of the Captive Tribes. According to Kitchener (who was a surveyor in Palestine long before he became a war lord) it is impossible to define the former limits of individual tribes, but there is evidence to show that these limits had disappeared altogether in certain cases before the Captivity. For instance, the tribe of Simeon appears to have retained the nomadic instincts of the race and to have become assimilated with cognate tribes such as the adjacent Edomites and Moabites, only retaining certain holdings within the regions occupied by Judah. Simeon, you will remember, occupied the southern extremity of Palestine, south of Jerusalem, and reached down to Bir-es-Saba (or Beersheba), which is now the base for Turkish military activity in the direction of Egypt. The Captive Tribes were, however, described as an "immense multitude" in the first century of our era by Josephus, and they were still "beyond the Euphrates." But as Josephus is the authority for the statement that a million Jews were destroyed with the fall of Jerusalem, and as this is an impossible number, we may perhaps discount the great multitude of the Israelites. There is nothing whatever to show that at this time (about the year A. D. 70, nearly eight hundred years after their captivity) they were anywhere but in the position assigned to them by the early chronicles—i. e. beyond the Euphrates. Still less can we discover evidence that they had migrated in a body to steppe regions beyond the Black Sea and had become incorporated with the Scythian tribes who had then spread into Europe.

A few words about these Scythian nomads may be interesting in view of certain fantastic theories (thoughtlessly accepted by thousands) that they absorbed the Israelites, or that, in some inexplicable manner, the Israelites became Scythians. When the Greeks began to colonize on the north coasts of the Black Sea, about the time that Samaria fell, they encountered these steppe nomads as they gradually extended trade eastwards by a route into Central Asia which crossed the steppes from the Don to the Ural (about Orenburg), and thence carried traffic southwestward to regions between the Jaxartes and the Oxus beyond Lake Aral.

From the Don to the Ural the route mainly traversed the country of a kindred people called Sarmatians, but on the Oxus and between the rivers Scythians again prevailed. Thus they were to be found at intervals in regions extending from the Oxus to the Black Sea, and, indeed, it seems probable that they were still farther west. They appear to have been first mentioned by Hesiod about 800 B. C., and, by the time of the Captivity, 721 B. C., a good deal was known about them, as appears from the writings of Herodotus. They seem to have occupied all Wallachia, and the Dniester was Scythian as far as the Greeks knew it. They were an immense and widespread people, and with them certain European peoples trace an ethnographic connection, based (with some probability) on the similarity of the name Sakai with Saxon, and the known direction and extent of the Scythian irruption into Europe. The Scythian hordes invaded Medea and overran Western Asia about one hundred years after the Captivity, and, after extending their raids into Palestine, they finally destroyed Nineveh. Then, if ever, the Scythians and the Israelites met. But we know that the Scythians retired northward again and that the Israelites were still an immense multitude beyond the Euphrates many centuries after the tragedy of Nineveh's fall. There was no absorption then, and it is inconceivable that it should have occurred after the days of Josephus and the destruction of Jerusalem.

It is, indeed, almost inconceivable that any considerable tribal emigration left the valleys of plenty and of great natural beauty which lie beyond the Euphrates in the uplands of ancient Medea and Armenia to search for a home in the South Russian steppes. The assimilation or absorption of the Israelites by the Scythian tribes may surely be regarded as an ethnographical impossibility. We are confronted with many problems of international assimilation when we deal with national frontiers, but an absorption of one people of strong individuality by another of totally different physical attributes, leaving no trace behind, is practically unknown. I am reminded of the story told about Sydney Smith who, when he was reminded that there will come a time when the lion will lie down with the lamb, replied: "Yes, but with the lamb inside the lion." That, indeed, is descriptive of a process of assimilation which leaves no trace; but no vigorous and virile people have ever been swallowed up in this way. The incomprehensible but immutable laws of heredity prevent it. The impress of physical feature and of character inevitably recurs, sometimes continuously, sometimes after long intervals; but the result is certain, and, indeed, that result is often comparatively independent of numbers and based far more on character. No trace whatever of Semitic (still less of Hebraic) admixture seems to be recognizable among the Saxons of Germany, whose claim to Scythian extraction is difficult to overlook. This is what Hippocrates says of the Scythians or Sakai, of his time: "They have stout, fleshy, flabby bodies, the joints concealed by fat, their countenances somewhat

ruddy. They all looked alike. They lived on boiled flesh, mare's milk, and cheese; they never washed, but enjoyed a narcotic intoxication in combination with a vapor bath The women daub themselves with paste, which they remove every second day." There is a certain irresistible suggestion of the stout beer-drinking Saxon of modern Germany in this unflattering portrait of a great people, a suggestion which imposes the conviction that Saxon and Scythian are of one original race.

After this more or less academic discussion, we turn again to the historical and geographical conditions, human and physical, of that old time-worn and well-trodden region between the Tigris and the Indus which has seen great empires and dynasties rise and fall and which is now relegated to a position among the nations which admits of no pride of race, no military importance—nothing but economic poverty and administrative incapacity. The rights of the highways through Persia, if not Persia herself, have become the desire of Western nations, and we hear loudly expressed political aspirations for the open "road to the East." What does the East mean? Does it mean Persia and Central Asia, or does it mean Afghanistan, India, and China—or all of them? I think we may take it that it undoubtedly means India directly and the rest ultimately. I have already drawn your attention to the fact that the iron rails of two great systems emerging from Europe now point eastwards, and that neither of the two belongs to England. One is Russian from the Black Sea, the other is German from Berlin and Constantinople.

Let us look at Russia's opportunities first. From Julfa, on the Aras, where the boundary between Russia and Persia is crossed, to Tabriz is only 93 miles; Tabriz being, perhaps, the most important commercial center in Persia, with a great trade in carpets, cotton, dried fruits, etc. Moreover, Tabriz is, or will shortly be, in direct connection with the great agricultural districts round Lake Urumia to the west, and by its connection with Tiflis it becomes an important branch of the whole great Russian railway system. We may be well assured that this important innovation into Persian territory was not undertaken for the sake of bringing carpets and raisins to the Russian market. We may indicate Teheran as the immediate military objective where railway extension will support the long-considered scheme of Russian domination throughout Northern Persia. To Teheran there is about 350 miles of somewhat narrow mountain approach under the shadow of the Elburz ranges; but it is a well-known route, carrying a telegraph line, which encounters no greater obstacle than one comparatively low watershed (I do not know the exact height of it) and a bridge over the Sefid Rud, before reaching the important town of Kasbin, about 100 miles short of Teheran.

From Teheran there opens out at once a magnificent prospect eastward—perhaps the greatest that the Eastern world affords. The military domination of all northern Persia would be incomplete without the support

of a railway skirting on its southern side the great mountain system which reaches from south of the Caspian to the western borders of Afghanistan. We may take it for granted that the necessary line will follow, backed by Russian energy and capital. If it follows the old trade highway to Shahrud, Bujnurd, and Kuchan to Meshed, it will not only tap, and at the same time develop, the resources of a most fruitful district of Persia, but it will set an end to the raiding proclivities of the Turcoman horsemen who still, from time to time, harry the open grasslands south of the mountains. From Meshed (about 550 miles from Teheran) will follow an inevitable 100 miles of mountain line to a junction with the Trans-Caspian system on the north, and the almost equally certain extension to the extreme Russian frontier post near Kushk, 80 miles north of Herat. Whether it will eventually reach the Oxus plains about Balkh and join up with that further branch of the Trans-Caspian system which is expected to link Bokhara with Termez on the Oxus (just north of Balkh) is at present unknown, but there is nothing to prevent it except the susceptibilities of Afghanistan, and in the fulness of time it may be looked upon as an almost certain issue. Equally certain in the long future (perhaps not so very long) is the connection with India. The connection via Herat, easy as it is, has often been discussed and as often dismissed from the category of immediate possibilities on account of the interposition of Afghan territory and the direct opposition of the Amir to railway extensions in his country. It is, however, not necessary that either Russia or we should trouble the Ben-i-Israel in this matter, for there is no insuperable obstacle to a connection via Birjand and Seistan, to the west of the Helmand River, a connection which would open out local commercial prospects which might eventually go far towards justifying the expense of maintenance. This, however, is not the only nor perhaps the best of the splendid opportunities open to Russia for Persian development and connection with India. So far we have dealt only with what will prove to be an essential condition of Russia's domination of northern Persia—i. e. the line from Teheran to Meshed. That will inevitably take the precedence of any more purely commercial enterprise as a necessary strategic condition. And here I may perhaps be permitted to record my opinion that Russia's control of northern Persia will be greatly for the benefit of the country and of the people, who will thus come directly into contact with her methods of civilization. Russia's goods will flood the markets, and Russian traders will compete with Armenians and Persians in these busy marts; but the great gain to northern Persia will be security and peace. Nor need we in the least fear the results of this acquisition of a new frontier to Russia, which has long been her natural heritage from its geographical position. Here it is not the Elburz system—which is readily crossed by the raider—but the vast salt midland deserts which form the best natural southwestern horizon to Russia's Trans-Caucasian provinces. The other obvious opportunity to Russian enterprise is a line

from Teheran southward to Kashan and Ispahan, and thence through the great commercial centers of Yezd and Kirman to Baluchistan and India. Such a line as this would be the making of Persia. Whoever builds this line holds Persia in his hands and must exercise paramount influence on her destinies. It is Persia herself who should construct such a line as this and secure for her revenues the enormous advantage of a great through mail service between Europe and the East.

Just what I have so lightly and so inadequately sketched may indicate Russia's position in that contest for the highways to the East which she is undoubtedly waging at present. Germany's position is perhaps not quite so clear. Absolute dominance in the Balkan States and in Turkey is the basis of it all, and the open line to Bagdad is the inevitable sequel which appears at present to be well within her grasp. But what beyond Bagdad? It is, I think, sufficiently clear that she might have visions of a line passing up the old Median Way to Kermanshah, and thence extending itself along that upland road which I have already pointed out as passing by Yezd to Baluchistan. But I very much doubt if any such ambitious program was ever regarded as a probable, or even possible, result of a Bagdad occupation. She might, again, look to lower Mesopotamia and an extension to Basra, thus securing for herself not merely the upper half but the whole wealth of the rich Mesopotamian plains when Sir William Willecock's great irrigation scheme ripens into an accomplished fact. That, indeed, would eventually amply repay the outlay on the whole project. It would be a magnificent contribution to the Eastern world's development, and it would bring Germany to a seaport at Basra. That, again, does not seem (so far as any indications as yet presented to the public are trustworthy) to be her present ambition. It brings her into direct conflict with Britain. The line to Bagdad in itself would sufficiently tap the broad wheat and cotton areas, and would go far to drain our Basra trade dry without any excursion southward. Moreover, when Germany makes a bid for Eastern commerce you may take it that her ambitions are wholesale and far-reaching. It is not merely Mesopotamia and Persia, or even India added, that fills her horizon. You must also add China, and remember the millions that she has already sunk in securing a footing in that Celestial republic (if it is a republic). That is perhaps why, in days before the war, it was not Basra that figured in German propositions, but the port of Koweit, south of Basra, commanding the seaway to Basra, and untrammelled by a long shallow-river approach with a bar and bottom of mud. That is perhaps why in these days, when any faint suggestion is made of the peace terms that would suit Germany, we always hear that England is to give up control of the sea. What does it mean? The North Sea and the Atlantic have ever been open to German shipping. Many of us have traversed the ocean in Hamburg-Amerika liners and found them comfortable enough. Her ships have been able to come and go as they please. But she has not been able to plant

coaling and, incidentally, submarine stations on any coast she pleased, nor has she obtained a port in Eastern waters between Suez and China. Here, I believe, we have the true explanation of German ambitions as regards Eastern trade—ambitions which would involve a direct threat to Indian traffic if not to India herself (for we must remember that India is far more vulnerable by sea than she is by land). This consummation of her hopes is for us to deal with—not for Russia—and the consideration of it brings us back to a fuller appreciation of the meaning of political domination in the Balkans and Constantinople, and, finally, of that command of the sea which is our heritage, and which is far more to us than any conquests or expansions by land that we are ever likely to contemplate.

We have, however, rather drifted away from the Tigris and the Indus whilst following out this brief consideration of the “road to the East,” the command of Eastern trade, which has become the dominant factor in the war. In conclusion, I would suggest that, apart from these war questions, which are necessarily of vital and immediate interest to us, there is ample and most interesting opportunity for inquiry and research into the academic fields of the history and ethnology in the regions which lie between the Tigris and the Indus. There is, I hope, a prospect that opportunity for such investigation is not far distant. We want to know more than we know at present of the Armenians and their records as well as of the Ben-i-Israel; and we want a closer geographical knowledge of all that lies between Herat and Kabul. Above all do we want a scientific examination of the site of the city of Balkh, which would surely yield results of importance and historical interest such as would rival even those of Nineveh.

THE HOMES OF BLINDFISHES

By CARL H. EIGENMANN

Dean of the Graduate School, Indiana University

Blindfishes are found wherever darkness or semi-darkness and isolation, conditions suitable for their existence, have prevailed for a sufficient length of time. They are found in the depths of the ocean, in limestone caverns, and in cracks and burrows of various sorts. Their distribution and characteristics form one of the highly interesting chapters of the science of zoögeography.

Blindfishes' eyes are in various stages of degeneration. In some blindfishes the eye begins to develop in the normal way, but sooner or later it lags behind the other structures in rate of growth and differentiation, and then it stops growing altogether. Some parts of the eyes stop growing sooner than others. Soon after the development of the eye has ceased, it begins to degenerate. The lens stops growing first and is the first part of the eye to begin to degenerate. The example of the lens is followed sooner or later by other portions of the eye, so that in old age there is frequently nothing left in the remotest way resembling an eye.

Most of the localities where blindfishes are found are monotonous in the extreme. The depths of the ocean know no changes from day to night, from season to season, from year to year. Such trifling changes as there are probably are not perceptible during the lifetime of any individual. Even in limestone caverns in the temperate zone, the diurnal changes are practically nil and the seasonal temperature changes are but slight. But there is much difference from place to place in the clarity of the water, the amount of water, and the rate of the current. The fluctuation in the height of the River Styx in Mammoth Cave, Kentucky, is said to amount to sixty feet. The river in Shawnee Cave, Indiana, sometimes fills the cave to the top, and in temperature it ranges from about 45° to 63° F.

Not all fishes living in dark places are blind or have defective eyes. It is safe to say that no fishes that depended on their eyes to secure food, to avoid being food, or to find mates have in the past either colonized caves or gone blind; and it is equally safe to predict that the descendants of the fishes now depending on their eyes will never become blind. The various blindfishes have all been derived from ancestors that could, and probably did, dispense with the use of eyes long before they came to live permanently in dark places.

Knowing the above facts, it is a comparatively simple matter to enumerate the families of fishes in which blind members may have developed or that may in the future give rise to blind members. The existing blindfishes



FIG. 1—Looking straight up from the bottom of one of the cistern-like caves near Cañas, Cuba, to the near-circular entrance of the cave. The tree, *Ficus*, sends several roots to the water in the cave.

FIG. 2—Looking obliquely down into the cave of FIG. 1. Notches have been cut in some of the roots, by which one descends to the bottom. Blindfishes can always be found in this cave.



FIG. 3—Blindfish River, Indiana, in flood. At such times it is not possible to enter the cave.

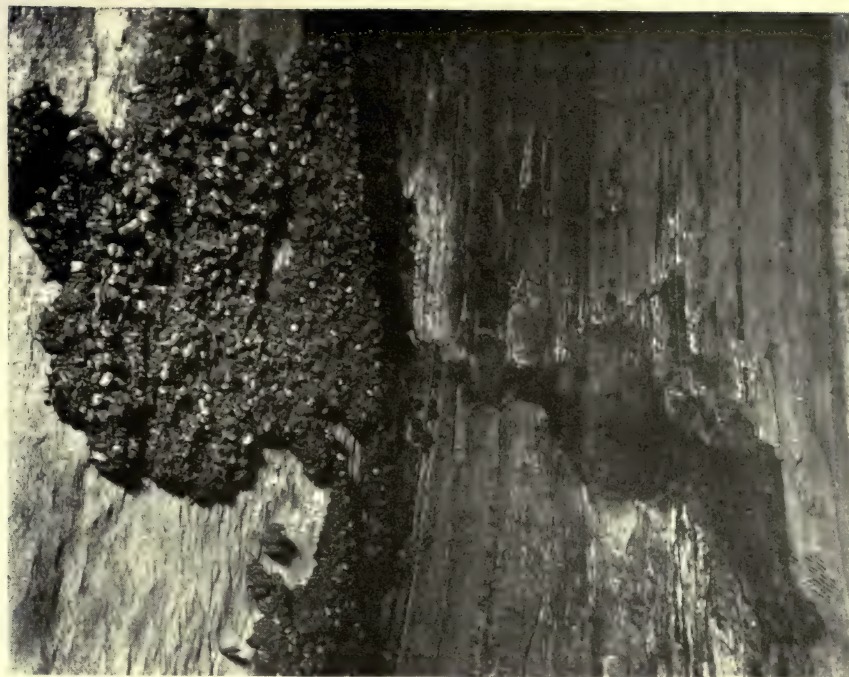


FIG. 4—Bats on the roof of Marble Cave, Missouri. Bats winter in many of the blindfish caves. The bats enter the cave in late summer and fall—apparently as soon as they are fat enough. They at first congregate in the deeper recesses of the cave. Towards spring, as the accumulated fat disappears, they move toward the entrance of the cave and make frequent trials of the out-of-doors. If conditions are unfavorable, they go but a few yards before they return to the cave. If they are favorable they remain outside. (Photo by C. H. Spurgeon.)

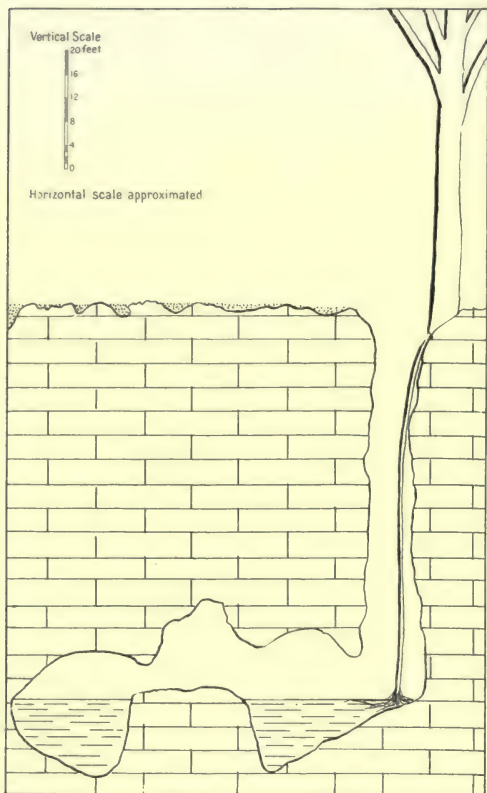


FIG. 5—Explanation on the right.

belong to nocturnal, as distinguished from twilight fishes, and to groups that detect their food and their mates by taste and touch or that live under rocks and in burrows of one sort or another.

I have had experience in catching blindfishes in California, Cuba, and the Mississippi Valley (in Indiana, Kentucky, and Missouri), and I have directed their capture in South America. The blindfishes in these different regions are not related to one another. They are related to epigeal, eyed fishes living in the same neighborhood.

FIG. 5—Cave Tranquilidad, southwest of Cañas, Cuba. Figs. 5 and 6 represent various types of Cuban caves. The masonry effect represents the native rock out of which the caves have been dissolved. The water in these caves is so charged with lime and manganese that a crust of these minerals is formed on the unruffled surface of the water as it evaporates.

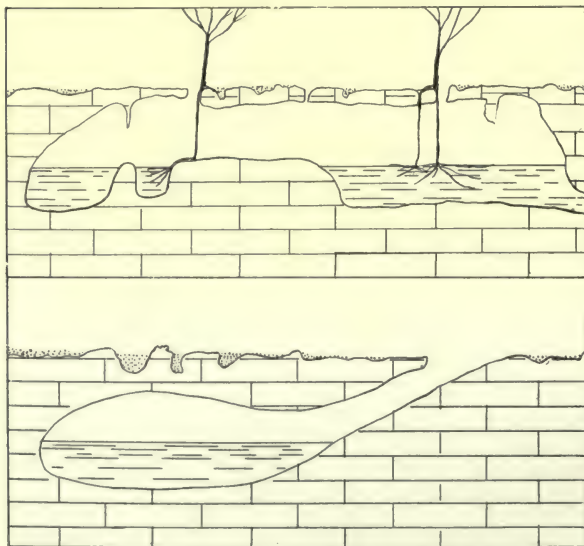
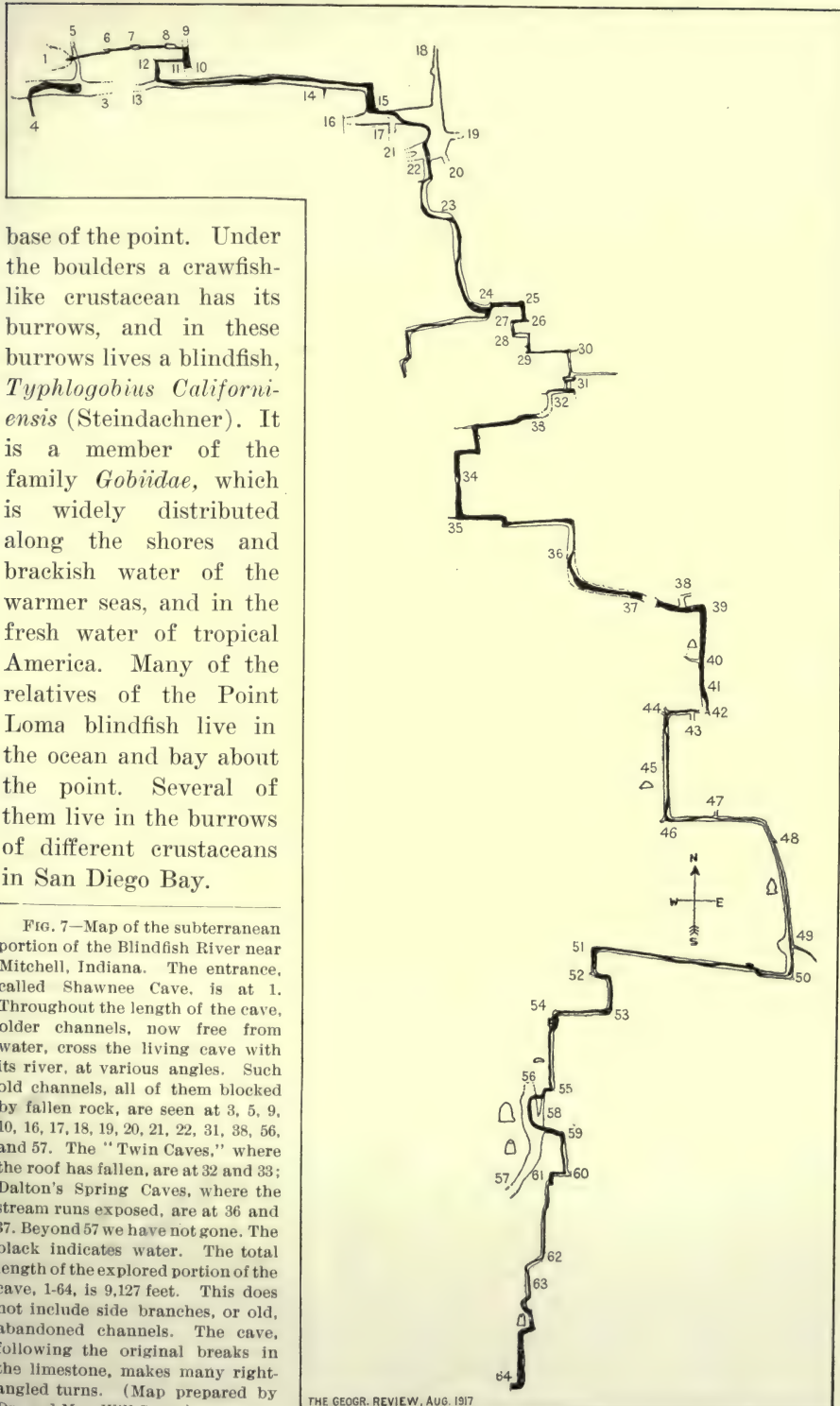


FIG. 6—Explanation on the right.

At San Diego, California, Point Loma sticks its nose into the Pacific. It is composed, among other things, of sandstone, gravel, and water-worn boulders. The waves of the ocean have gnawed off the margin of the point and crumbled up the material at its base. Many of the boulders washed down are half buried in the sand at the

FIG. 6—(Upper) Diagram of a cave near Cañas, Cuba. (Lower) Cave on the Finca San Isidro. For general explanation see Fig. 5.



base of the point. Under the boulders a crawfish-like crustacean has its burrows, and in these burrows lives a blindfish, *Typhlogobius Californiensis* (Steindachner). It is a member of the family *Gobiidae*, which is widely distributed along the shores and brackish water of the warmer seas, and in the fresh water of tropical America. Many of the relatives of the Point Loma blindfish live in the ocean and bay about the point. Several of them live in the burrows of different crustaceans in San Diego Bay.

FIG. 7—Map of the subterranean portion of the Blindfish River near Mitchell, Indiana. The entrance, called Shawnee Cave, is at 1. Throughout the length of the cave, older channels, now free from water, cross the living cave with its river, at various angles. Such old channels, all of them blocked by fallen rock, are seen at 3, 5, 9, 10, 16, 17, 18, 19, 20, 21, 22, 31, 38, 56, and 57. The "Twin Caves," where the roof has fallen, are at 32 and 33; Dalton's Spring Caves, where the stream runs exposed, are at 36 and 37. Beyond 57 we have not gone. The black indicates water. The total length of the explored portion of the cave, 1-64, is 9,127 feet. This does not include side branches, or old, abandoned channels. The cave, following the original breaks in the limestone, makes many right-angled turns. (Map prepared by Dr. and Mrs. Will Scott.)

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FIG. 7—Explanation on the left.

In various places in the Mississippi Valley there are more or less extensive limestone caverns. They are abundant in Missouri, where streams of larger or smaller dimensions course through them, to emerge again beyond. Such caves exist at Sarcxie, Roaring River, Springfield, and other places. The caves about Sarcxie harbor a small blindfish in which the eyes have all but vanished. The caves of Kentucky have long been known to harbor two or three different blindfishes, as well as a close relative not actually blind. In Indiana blindfishes have been found from Wyandotte Cave near the Ohio River to Mitchell. The caves in which blindfishes are found more abundantly than elsewhere in America are east of Mitchell, Indiana. Here large areas are covered with sink holes that drain into underground streams which find their exit in the escarpment along White River, sometimes in gorges and caverns of rare beauty. The largest of the underground streams, which leaves its tube by Shawnee Cave, and which can be reached at four other places where the roof has fallen, runs under a tract of land containing 182 acres. This land escheated to the common-school fund of Indiana. The legislature authorized the trustees of Indiana University to buy the land. It is now under the management of Indiana University and will be preserved as a natural monument for future generations.

All of the blindfishes of the Mississippi Valley belong to one family. There are but seven species of this family known to naturalists, and most of them are found in caves. They are the blindfishes *par excellence*.

One, *Troglichthys rosae*, is confined to the caves of southwestern Missouri; *Amblyopsis spelaeus* is found in Indiana and Kentucky. *Typhlichthys* is also found in Indiana and Kentucky, but the species of Indiana is different from those south of the Ohio. There are apparently two species in Kentucky. All externally visible, ornamental differences, such as distinguish different related epigean species, are absent in the blind cave fishes. They are all pink. The eyed relatives of the blindfishes are *Chologaster papilliferus*, living in a cave spring in southern Illinois; *Chologaster agassizii*, found in the caves and springs of Tennessee and Kentucky; and *Chologaster cornutus*, which lives in the swamps of Georgia, South Carolina, and Virginia. The places in which the different species of these fishes live are, for the most part, separated from each other by effective barriers. The Ohio and Mississippi Rivers are probably as effective barriers to the blindfishes as now developed as so much sand would be.

In Conestoga Creek, a tributary of the Susquehanna in Lancaster County, Pennsylvania, Cope secured some blind catfishes with eyes in a variable transition stage. They are simply a blind representative of the ordinary type of Silurids characteristic of North America.

Much of western Cuba is drained by underground streams. From one of them Havana is supplied with water. The streams sometimes run above ground for a distance, then run below ground and reappear again near the coast or even under the surface of the ocean. In many places both east and



FIG. 8.

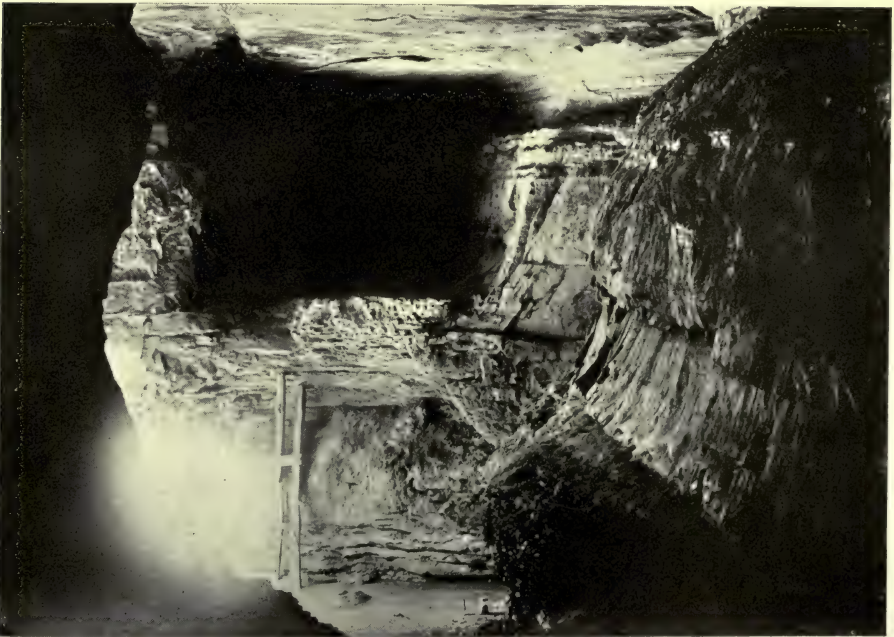


FIG. 9.

FIG. 8—Looking into the south portion of the abandoned dry cave just within the entrance to Shawnee Cave. The abandoned channel has been cut in two by the living cave. During very wet weather a little water still flows out of this channel. For indication of size, note the collecting net on the right wall. (Photo by Drs. F. Payne and N. Miller.)

FIG. 9—Looking north into the continuation of the dry cave, opposite the one shown above. This portion is permanently dry. A few tools once used by Indians were found in this part of the cave. Light entering the cave and reflected from the wall has fogged the spot in the lower left corner. For indication of size, note the collecting bottle on the ground. (Photo by Drs. F. Payne and N. Miller.)

west of Havana there are *cenotes*, or natural wells or caves. The ground may be quite level, when one comes suddenly on a circular opening of greater or less extent. This usually leads into a conical, sometimes irregular cave containing water in which blindfishes are found. Sometimes half of the roof of the cavern has fallen so that one can walk down to the water, but usually one has to climb down. This is often made easy by a tree, *Ficus*, which is found at the mouth of the cave and sends aërial roots through the cave to the water.

In many of the caves of Cuba stalagmites rise from some distance below the water, showing that the water in these caves has risen in recent years, that is, this portion of the island has been lowered. The water is surcharged with lime and magnesium, and, as its surface is not disturbed, a crust of these minerals forms over the water with evaporation.

The blindfishes of Cuba, two in number, *Lucifuga* and *Stygicola*, have their nearest relatives in the surrounding ocean. They belong to the marine family *Brotulidae*, and their relatives are all found in the ocean. *Stygicola dentatus*, the larger of the Cuban blindfishes, is found both east and west of Havana, on both the north and south slope of the island. *Lucifuga subterraneus* is found only on the south slope west of Havana.

In southeastern Brazil, in the province of Santa Catharina, there are caverns containing blind catfishes, *Typhlobagrus Kronei*; the eyes of these are remarkably variable. Some specimens have no eyes at all, others have fairly developed eyes. They seem to be blindfishes in the making. Some of them have not yet arrived. Their relatives, *Pimelodella transitoria*, living outside these caves, are so similar to them that there can be no question about the origin of these blindfishes.

On the island of Marajó, opposite Pará, there is another blindfish. It is so different from the other South American fishes that we cannot say just what the ancestral species and genus were, although it was certainly near *Pygidium*, another of whose relatives is going blind in the plains of Bogotá.

In the streams of the high plateau surrounding Bogotá, "El Capitán del Bogotá" is very abundant. It is a speckled, eel-shaped, but shorter and thicker fish of a genus and species peculiar to the region about Bogotá, *Eremophilus mutisii* (Humboldt). It is provided with a number of barbels and has the habit of burrowing in the banks and bottom of the streams. I have seen many of them with but slight local variations. Recently I secured three specimens. One is without color, and normally colored in spots, and the eyes are normal. The second one is without color except in the normally developed eyes, which are black. The third is without color, and the eyes are also without color and scarcely visible externally. It is a blind fish. The first one has the appearance of a cross between the normal Capitán and one of the bleached blindfishes.

The development of blindfishes has very probably been along normal

orderly lines of evolution and by processes still in operation. The cataclysmic origin, of which the origin by mutation is a modified revival, has been suggested and may not have been altogether excluded in one form or another, but it could only have been effective in a fish otherwise a proper candidate for blindness.

The processes by which the Point Loma blindfish has reached its present estate have been retained in various stages by its relatives. They live in burrows, but habitually lie in the pools about the burrows, descending only to escape danger. One can see them in numbers in the minute pools left at low tide. At the slightest danger they dive into their burrows. The blindfish has gone a step further. It lives permanently in the burrows. This does not mean that it may not occasionally come into open pools, but it could not maintain itself there, it could not avoid its enemies. If any foodstuff comes into contact with it anywhere, it turns flash-like to seize it.

The *Amblyopsis* of the Ohio Valley offers the double problem of its origin and its present distribution, being found both north and south of the Ohio. Its distribution can perhaps best be explained on the assumption that it did not originate at one point but developed all over its present range from its widely distributed ancestors with eyes. The salamander, *Spelerpes maculicauda*, is now becoming a permanent cave animal all over its range, wherever there are caves to be found. The cause and method of the origin of the present condition of the blindfish can best be seen at Horse Cave, Kentucky. At this place an east-and-west valley crosses a north-and-south valley. The north-and-south valley leads to the Green River Valley. The valleys at Horse Cave carry no water. The stream that is responsible for them runs 185 and more feet beneath the town of Horse Cave. The capping of the hills surrounding the valley is sandstone, the lower part limestone. The stream at one time ran above ground, first over sandstone, later over limestone, and drained into Green River. As the largest stream, Green River, lowered its bed more rapidly than the smaller ones, joints in the limestone became exposed, through which at first a small part, then, as the joints became enlarged by solution, more and more of the water of the valley found its way to Green River by subterranean channels. Later all the water ran below ground under normal conditions, and only during freshets did part of it run above ground. The various stages of the process can still be seen in the Lost River region of Indiana.

When the stream ran above ground, it probably had a varied fish fauna. Some of the fishes were pelagic in their habits, others haunted the shores and weeds, still others lived in crevices and under rocks. There may be assumed just such a fauna as is now found in Green River. As the Horse Cave Creek gradually disappeared beneath the ground, the pelagic and littoral fishes went out into Green River, those that were in the habit of finding their food and escaping their enemies in cracks and under stones stayed with the creek in its burrowing, and their modified descendants remain



FIG. 10.



FIG. 11.

FIG. 10—Base of Point Loma, San Diego, California. Under the rocks in the burrows of a crustacean lives the Point Loma blindfish. It is a marine fish with various seeing relatives in the ocean and the Bay of San Diego. The blindfishes attach their eggs to the under side of the rocks. The young develop normal-sized eyes, which later lag behind in their development and degenerate with age.

FIG. 11—Looking across a valley near Horse Cave, Kentucky. The stream now flows nearly two hundred feet underground. Most of the animals which inhabited it when it flowed above ground migrated out to Green River when the stream was "lost." The ancestors of the blindfishes and the blind crawfishes went down with the river. Their modified descendants, the small blindfish and the blind crawfish, still live in this underground river.



FIG. 12.



FIG. 13.

FIG. 12—Portion of the rocky beach near Matanzas, Cuba, farther back from the line of action of the waves. The pits in the surface of the rock have become filled with sand, which supports a scanty vegetation. A well in a rift only a few hundred yards inland from this point and only a few feet higher harbors many freshwater blindfishes.

FIG. 13—Rocky ocean beach within reach of the waves at Carbonera, near Matanzas. About these shores lives *Brotula*, a fish very closely related to the Cuban blindfishes. As similar rocky beaches became elevated and the sea water contained in the crevices was replaced by fresh water, the ancestors of the Cuban blindfishes became acclimated to fresh water.

today as the blindfishes of Kentucky. They grew up with the country, or rather, went down with the river.

The blindfishes of Cuba are similarly the result of the development of the island. Where we find, in any animal, a complex adaptation to a complicated unit of environment, there has probably been a concomitant development of adaptation and environment, as armor and armor-piercing projectiles are concomitant developments.

As stated, the relatives of the Cuban blindfishes do now, and the ancestors of the blindfishes probably did formerly, live in and about the coral reefs of Cuba. At Carbonera, near Matanzas, a crevice or rift can be seen in the coral beach a few feet above sea level. Its bottom is filled with sea water. A short distance inland is another similar rift in a beach at a slightly higher elevation. Its lower part is filled with fresh water and contains many blindfishes! The suggestion naturally offers itself that these fresh-water blindfishes were salt-water fishes living in this rift of the coral beach and that they remained in the rift as it became elevated and its water became gradually fresh. That they have become modified in further adaptation to their fresh-water and cave environment, goes without saying. They have always lived where they live now, but as the armor became modified, the adaptation of the projectile to armor also became modified.

The method of rearing the young is very different in the three blindfishes whose breeding habits we know.

The Point Loma blindfish lays eggs in clusters attached to the lower surface of rocks. They swell up and become elongate club-shaped soon after deposition. The young develop large eyes.

The Ohio Valley *Amblyopsis* has a peculiar adaptation to care for the young. The opening of the oviduct is far forward, and the eggs are deposited in the gill cavity to the number of about seventy. They are carried in the gills until after the young hatch and the yolk is absorbed, when the fish are about a quarter of an inch long. The eye begins to develop in the natural way, but very soon first one and then another part of the eye gives up, stops developing, and sooner or later begins to degenerate, so that in the very old there is nothing left but pigment and a few fragments of cartilage.

The Cuban blindfishes give birth to living young about an inch long. At birth the eyes appear well developed and are movable. They also begin to degenerate with age and growth and nearly reach the vanishing point in old age.

THE TRAVELING DOCTORS OF THE ANDES: THE CALLAHUAYAS OF BOLIVIA¹

By G. M. WRIGLEY

Anywhere between Bogotá and Buenos Aires you may meet these strange exponents of the healing art; among the thronging crowds at the great fairs and the pleasure seekers of the fiestas; in the hut of the mountain shepherd and with the gaucho of the plains. Traveling first class on a southbound steamship from Guayaquil or tramping on foot the desolate road of the Chilean desert the Callahuaya is equally at home.² All the secrets of the Cordillera are his, the hidden springs, the best natural shelters—for he scorns the protection of a roof, the shortest cuts. His peculiar disregard of the trodden way is expressed in a popular Aymará phrase, *lagui tuppu*, the road of the Indian, or “as the crow flies.”³ With the Callahuaya the attire proclaims the man: it is quite distinct from that of Quechua or Aymará in its combination of black breeches, red or red-and-white poncho elaborately patterned, bright scarf round the waist and broad-brimmed sombrero of vicuña wool or finest Guayaquil straw. On the breast is worn the huge cross of virgin silver, distinctive mark of the calling. Adorned maybe with false green gems, it and the crude silver finger rings are of recent Argentine fabrication, contrary to their appearance of antiquity. On the other hand the *Kapacha*, or *Chuzpa* as it is termed if smaller, is of native workmanship. This is the wallet that, slung across the shoulder, carries the stock in trade. It is exquisitely made but from our fastidious point of view is spoiled by the invariable layer of dirt and grease. The contents alone betray their vendor, and often from a distance, for they include aromatic gums, resins, barks, and herbs from the hot forests.⁴ But these simples do not constitute the entire outfit. The esoteric art of the Callahuaya extends beyond mere drugs. A necromancer, he carries with him charms to meet the emergencies

¹ The most important material consulted for this article is an unpublished manuscript of the late Adolph F. Bandelier kindly put at the disposal of the Society by Mrs. Fanny Ritter Bandelier. It is a matter of great regret that Mr. Bandelier was unable to complete his promised report on the Callahuayas (see “The Islands of Titicaca and Koati,” footnote 123, p. 155), for he is the only scientist who has made any real study of these little-known Indians.

² According to Bandelier there are authenticated cases of the Callahuaya traveling to Rome, and it is asserted with some show of probability that they have gone as far as the Holy Land. Vicuña Mackenna reports (“El libro de la Plata,” Santiago, 1882) that among the very few travelers on the desert roads of the mining zone before the greatest silver discoveries were “solitary caravans of the Indian physicians of Carabaya, who, walking a thousand leagues in a year, visit our cities of the Maule and the Biobío.”

³ Mrs. M. G. Mulhall: *Between the Andes and the Amazon*, London, 1881, pp. 115, 116. *Memoirs of General [William] Miller*, Vol. 2, p. 239, London, 1829.

⁴ Carlos Bravo: *Clasificación de las Plantas Medicinales usadas en la Farmacopea Callahuaya*, La Paz, 1889. According to Bandelier this contains errors, and the names of plants are given in Aymará and not in Callahuaya but it is valuable in that the list incorporates plants used, not by the Callahuaya alone but by the inhabitants of Bolivia in general, as household remedies.

A list of items in the Callahuaya pharmacopeia is given by C. B. Cisneros: *Geografía Comercial de la América del Sur*, Lima, 1897, p. 115.

of every-day affairs in the Andes. There are little carved stone figures representing llamas, sheep, or cattle. Manipulated with appropriate ritual they will ensure prosperity among the flocks. Several of these objects were seen by Boman in the Diaguite region where they are known as *illa*.⁵ With red wool also used in the pastoral ceremonial they had been purchased from Callahuayas. Similar forms have been discussed by Uhle, who saw them on sale in the plaza of Sicuani and learned their use from an Indian.⁶ He describes little figures of sheep having holes on the back exactly like those of ancient forms. According to his Indian informant the holes were filled with alcohol, coca, and the like sacred substances, and the sacrifice, for such it is, was buried in the pastures. With them the Indian pays Pachamama, the Earth, for the boon of the pasture. The figure is placed in the ground between stones and covered with a stone. Each time the annual sacrifice is renewed the new offering is placed under the old, that is, in closest proximity with Pachamama.

A variety of charms cover the needs of agriculture. Prosperity in general, in popular demand of course, is secured by a common form, the clenched hand frequently engraved on the inside with a circle representing a piece of money. Most of the *mullu*, or "stones of Charasani," as they are commonly called, are of the white alabaster abundant in Charasani, but some, especially among the human figurines sold in secret, are black—for the working of evil.⁷ Among educated people the Callahuaya does not enjoy an altogether admirable reputation, and he is usually reticent when questioned by whites, though even here his astuteness does not fail him. What cynical philosopher has bettered his retort when asked for the secret of woman's love? "It is to have money." His dealings with the natives are typified in an incident witnessed by Bandelier: "On the road from Huata to Achacachi some Callahuayas stopped a party of Indian freighters. They took one of them aside and told him he was sick. The Indian denied it but they finally convinced him that he had a headache. Thereupon the Callahuayas sold him about 40 cents (gold) of ordinary snuff, charging him as much again for the cure. He was relieved indeed of his supposed headache and also of a good part of his hard-earned cash!" Another trick of our charlatan, practiced also by the Aymará medicine man,⁸ is related by Ascarrunz.⁹ In the course of his travels the Callahuaya prosecutes inquiries for Indians who are ill. If any such is discovered he commences operations. At night he buries a toad or some like repugnant creature

⁵ Éric Boman: *Antiquités de la région Andine de la République Argentine et du Désert d'Atacama*, 2 vols., Paris, 1908; reference in Vol. 1, p. 132. See also Vol. 2, pp. 496, 511.

⁶ Max Uhle, *Revista Historica*, Vol. 1, p. 389, Lima.

⁷ Bandelier describes the Callahuaya fetishes ("The Islands of Titicaca and Koati," pp. 105, 106). He found it exceedingly difficult to obtain information on the practice of the "black" art and impossible to secure specimens of the fetishes used.

⁸ Bandelier, *op. cit.*, p. 120.

⁹ Adolfo Ascarrunz: *Los Callahuayas*. App. II to Rigoberto Parades: *Monografía de la Provincia de Mufecas*, *Bol. Soc. Geogr. de La Paz*, Vol. 1, 1898, No. 2, pp. 42-51.

near the house of the victim and, presenting himself the succeeding morning as a casual visitor, is solicited to perform a cure. After a duly decorous period of importunity on the part of his dupes he consents and proceeds



FIG. 1—Map showing location of Curva.

to make a divination, using coca leaves for the purpose in much the same way as a gypsy "throws" the cards. The divination concludes with the unearthing of the toad, whereupon the patient improves and the Callahuaya receives his fee and departs.

One traveler in the Central Andes has summarized the wide range of the

Callahuaya's activities thus:¹⁰ "The *taita* (priest) is venerated as the dispenser of the heavenly blessings, but he is far from enjoying the authority of the Collahuaya [sic], the native oracle. He is newsvendor, peddler, doctor, diviner. He plays a political rôle, announcing the coming of an Inca liberator of the oppressed race¹¹ . . . in a native village he is arbiter of quarrels and lawsuits, teller of fortunes, purveyor of love-potions, minstrel, story-teller, merchant, veterinary surgeon, receiver of confidences." Even if this portrait is somewhat overdrawn, it is an undoubted fact that the Callahuaya has the entire confidence of the native and not a little of the respect of the more ignorant white.

Whence comes he, this strange exploiter of his fellows? The names by which his tribe is known in various parts of the continent give approximate ideas of his home. "Chirihuana,"¹² as he is called on the Peruvian coast, places him beyond the Eastern Cordillera, though too far south;¹³ "Yungeño," as he figures on the pampas of Buenos Aires, is nearer, for it suggests the eastern valleys of the department of La Paz. The "Colla"¹⁴ or "Coya" adopted in northern Argentina connects him with the Titicaca basin. Actually he comes from the border between these two great regional divisions, the *altiplano* and the eastern valleys. Charasani, Consata, Curva, and other villages of the provinces of Muñecas and Larecaja, department of La Paz, have been stated as specific habitations. Modesto Basadre,¹⁵ who gives a short but pertinent account of the tribe, refers only to Curva, and Bandelier emphatically states it to be the sole residence of the Callahuayas.

Among the towns of Muñecas, Curva occupies a unique position. This may be realized by a glance at the topographic and climatic divisions of the province. The range is great; most of the varied regions of Bolivia are here represented. From a narrow strip of the high tableland on the southwest rises the snowy Cordillera of the Eastern Andes. Its summits in Muñecas reach heights of 19,000 feet and more;¹⁶ they are imposing though not quite as superb as the line of "royal peaks" of the true Cordillera Real, carved out of the granite axis of the Cordillera from Illampu to Illimani. The limit of perpetual snow is about 16,000 feet; below, to elevations of 12,000 or 11,000 feet, is *puna* country, whose human importance is confined almost solely to the pastures, except where mineral wealth has proved an attraction. On the graded mature slopes on the southwestern border of the Cordillera is one of the most famous pastoral districts of the

¹⁰ Baron Meyendorff: *L'Empire du Soleil: Pérou et Bolivie*, Paris, 1909.

¹¹ Andrews ("Travels in South America," London, 1827) conceived this idea also. There is no authority for it, yet in view of the maintenance of the old Peruvian traditions and customs it is quite conceivable. A species of play representing the "Death of the Inca" is still performed.

¹² William Bollaert: *Antiquarian, Ethnological and Other Researches in New Granada, Equador, Peru and Chile*, London, 1860, p. 250.

¹³ Vicente Pazos: *Letters on the United Provinces of South America*, 1819, p. 79.

¹⁴ Ludwig Brackebusch: *Viaje á la Provincia de Jujuy*, Buenos Aires, 1883 (?), p. 26.

¹⁵ "Riquezas Peruanas escrito para 'La Tribune,'" Lima, 1884.

¹⁶ The height of Sunchulli is given as 20,015 feet (Censo Nacional de 1900).



FIG. 2—The Callahuaya: the Traveling Doctor of the Andes. The woven bag (see Fig. 6) and the large silver cross are distinctive of his calling.

Andes. The high, cold pastures of the region around the meeting point of the Bolivian provinces of Muñecas and Caupolicán and the Peruvian province of Carabaya, that is around the knot of Apolobamba, afford optimum conditions for alpaca raising. The wool has long been an important export from the region, a circumstance that stimulated the growth of this section when the boundary dispute was settled by the rectification treaty of 1909. A larger area in Muñecas is occupied by the eastern slopes of the Cordillera. Here, under the heavy rains of the trades, dissection has proceeded far; deep-cut ravines penetrate into the heart of the Cordillera. Profiles are ungraded; rapid descents give great climatic changes within short distances. In the altitudinal and climatic zone designated *cabecera de valle* (head of the valley), about 10,000 feet, maize and wheat cultivation is dominant. Farther down, in *medio valle*, about 8,000 feet, subtropical fruits are at their best and coffee begins to be cultivated, while still farther below, in *los valles*, commence the *yungas*, 5,000-6,000 feet, with coca plantations set in the midst of the extraordinarily rich and varied tropical vegetation of the lower *montaña*.

The relationship between the people and the resources of these zones of the Eastern Cordillera is identical over a large area extending north and south of Muñecas. One of the best descriptions of it is found in Markham's "Travels in Peru and India." Written over fifty years ago it applies perfectly to the region today, and for purposes of comparison it will be advantageous to recall here the statements in regard to distribution. They relate particularly to Carabaya, the Peruvian border province contiguous with Muñecas and Caupolicán.

The ultimate wealth of Carabaya, "the golden," lies in the produce of the hot valleys—the cacao, coffee, coca, and rubber—as well as the deposits of metallic gold that bestowed the epithet upon the province. But the present inhabitants reside almost entirely in villages in the upper parts of the valleys in the *cabecera de valle* or the higher part of the *medio valle*, that is particularly in the maize and wheat zone more or less accessible to the pasture lands of the spur tops—many of these upper valley dwellers owning in addition coca patches in the lower reaches. The villages so situated, of which Cuyo-cuyo, 10,500 feet in elevation, is a good example, have practically no intercourse with one another: each little community is shut off from its neighbors by the wild Andine spurs, or precipitous valley walls. Communication indeed is only possible by pursuing the valley road to the head, crossing the Cordillera onto the plateau, and thence recrossing by the pass proper to the valley sought. From this circumstance has arisen the fact that Crucero, on the plateau and remote from the geographical center of population, has been created capital of the province. Its central location in regard to the passes and trans-Cordilleran routes compensates for its bleak *puna* climate and barren resources.

The geographical relationships for the country south of Muñecas have

been discussed by Evans in his "Expedition to Caupolican Bolivia,"¹⁷ and his journey down the famous Tipuani valley may well be compared with that of Weddell.¹⁸

In Muñecas¹⁹ the centers of population are in the upper valleys; as Parades expresses it, "each one in the *quebrada* proper to it." It is noteworthy that Muñecas (old province) is one of the five most densely populated provinces of Bolivia, its density at the 1900 census being 30 per square mile (11.36 per sq. km.). Its nine urban centers account for 7,373 people, something over one-fifth of the total population. Of them eight are in the valleys. Mocomoco, with 1,477 people, is in the maize zone at 10,200 feet: Charasani, 787 people, and Italaque, 785 people, are also in the *cabecera de valle*; Chuma is reported to possess a "sauve and serene" climate, the best of the province; it has a population of 1,419. Ayata, a great producer of maize, numbers 1,216 urban population. It includes some of the largest, most valuable and most productive *fincas* of the province: its rural population is 4,524. Camata, on the border of the *yungas*, is hot and its population, 277, is the lowest. Of the nine cantons only Curva is on the *puna*.

The situation of Curva is described by Bandelier as peculiar and picturesque. "It lies at a considerable altitude on a bleak saddle at the base of the imposing Nevada de Accamani. On two sides the slopes go down to appalling depths, narrow and full of precipices with the exception of one only which leads from Charasani to Pelechuco." The town, clustered round the small, wretchedly kept plaza, has the usual dismal aspect of a *puna* settlement. Of its total population of 323 only 10 are white, the remainder being Callahuayas. Why do they reside here? What are the advantages of the *puna* location?

Pelechuco, with an altitude above the average and "occupying a sombre, mist-filled valley," is the outlet for the greater part of the trade of Caupolican Bolivia. Crucero, the bleak capital of Caravaya, is likewise a commercial center. Curva has no commercial movement of this sort. A limited agriculture, potatoes and barley, is practicable, but it is subordinated to the care of the flocks. Gold washing is carried on in a desultory way at the foot of Sunchulli, but the prosperity of Curva, whose inhabitants are the richest of the province, is not dependent on these industries. They are chiefly the work of the women; the men, the wealth-gainers, are employed in the curious itinerant profession that has made them famous throughout

¹⁷ *Geogr. Journ.*, Vol. 22, 1903, pp. 601-646.

¹⁸ H. A. Weddell: *Voyage dans le nord de la Bolivie*, Paris, 1853.

¹⁹ By a law of 1908 the Bolivian government created a new province, Camacho, from portions of Muñecas and Omasuyos. Apparently the new province includes a part of the eastern slope of the Cordillera as well as the western slope in Muñecas and its continuation in Omasuyos to the shore of Lake Titicaca. It comprehends the old cantons of Mocomoco, Italaque, and Ambaná, formerly belonging to Muñecas. As the distribution of population within them is not unlike that of other districts of the province, the old political division has here been considered for distributional purposes. See *Bol. Direcc. Gen. de Estadística y Estudios Geogr.*, No. 89, La Paz, 1914, pp. 218, 219.



FIG. 3.



FIG. 4.

FIG. 3—Curva occupies the notch in the crest of the spur on the right. In the background are the snows of the Eastern Cordillera of the Andes; the foreground slopes are terraced barley and potato fields.

FIG. 4—Curva lies in the notch at the top of the mountain in the center of photograph. It is not surprising that the natives of this wild and isolated region make their long journeys with so little regard of the trodden road and the ordinary conveniences of the traveler.

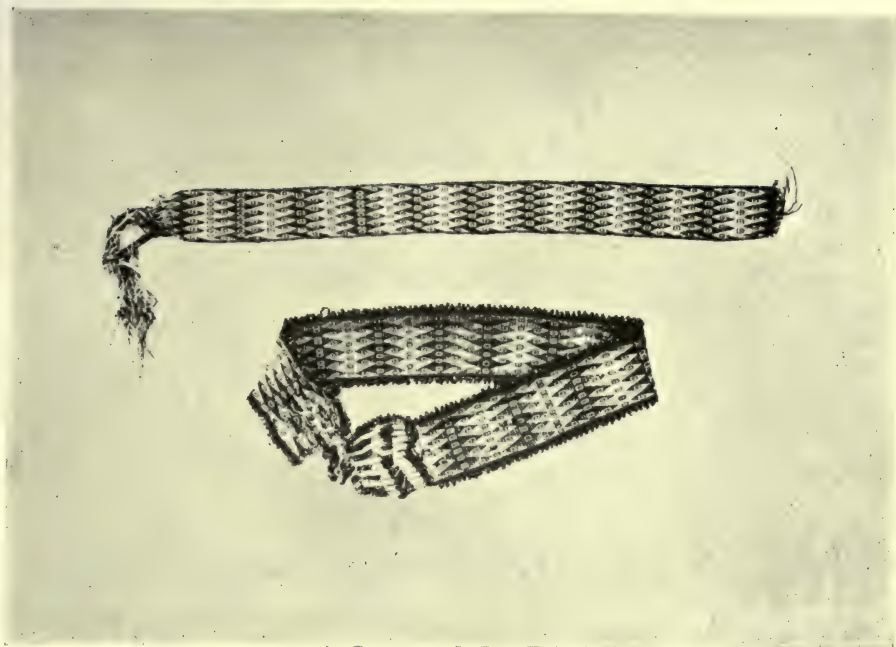


FIG. 5.



FIG. 6.

FIG. 5—Callahuaya head bands. The unfinished band shows the loose threads which will be worked into the tassels worn dangling over the ear.

FIG. 6—The beautifully woven bag in which are carried the drugs and charms that constitute the stock-in-trade of the Callahuaya.

the continent. It has already been described from the outside: it may now be examined in closer relation to the home environment.

The journeys vary in length from a year to three or four or even five years. They are never undertaken by single individuals but always by companies, at times of as many as eight or ten persons. The women sometimes accompany their husbands on the road to Charasani or go as far as that to meet them on their return; otherwise they remain at home. According to Parades, strict measures are taken by the husbands to ensure the fidelity of their wives, though others say that on his departure the Callahuaya hands over his wife to a friend and on his return adopts any children born during his absence.²⁰ Under the peculiar circumstances of their life such a moral code is not improbable; it would be comparable with that obtaining among the people of the Puna de Atacama, where her illegitimate children are the accepted *dot* of the bride.²¹ On his travels the Callahuaya has a reputation for unusual sobriety, though he is reported to engage in drunken orgies on his return home. Likewise remarkable is his "lively and open disposition," as one traveler puts it,²² in contrast with the customary reserve and stolidity of the plateau Indian. Regarding the religious practices of the Callahuayas there is conflicting evidence, but Bandelier asserts that they always have a solemn mass said before leaving on their journeys and they promise rich gifts for the church in the event of their safe return. Such promises are faithfully kept, and Bandelier himself saw handsome church vestments which had been brought home by them. The journey is prefaced by a trip to the *montaña* for outfitting the wallets. As this trip takes them into the hot country they wear little clothing for it, a circumstance which has led some travelers to suppose the forest their actual home.²³

The returning Callahuaya brings with him money, horses, mules, and an infinite variety of merchandise, much of which is sold in the adjacent hamlets of Inga, Chajaya, and Kanglaya. These small villages appear to be veritable emporiums. Bandelier was told that anything might be purchased there, from a tasteful bonnet and elegant shoes to a sewing machine and a harmonium!

Such is practically the extent of our knowledge of the life and customs of this strange little human group. How can its peculiarities be explained? Whence originated this form of nomadism? The Callahuaya has been called the "gypsy of the red race";²⁴ but the term is not really appropriate, for he

²⁰ Hugo Reck: *Geographie und Statistik der Republik Bolivia*, *Petermanns Mitt.*, 1865, pp. 257-261, 281-295, 1866, pp. 299-305, 373-381, and 1867, pp. 243-251, 317-329; reference on p. 377 (vol. for 1866). Reck also refers to the Callahuayas' custom of taming mules they bring from Argentina by stopping the beasts' ears with wool.

²¹ Isaiah Bowman: *Results of an Expedition to the Central Andes*, *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, p. 172.

²² S. S. Hill: *Travels in Peru and Mexico*, London, 1860, Vol. 2, p. 12.

²³ J. J. von Tschudi makes a statement to this effect. He describes their use of the juice of the *huito* as a protection against insect stings. See his "Travels in Peru During the Years 1838-1842," New York, 1849.

²⁴ The Callahuaya has also been compared to the "early traveling physicians of Greece." Professor Walter Woodburn Hyde, however, is of the opinion that there never were "traveling physicians," either in early times or late, and that the notion arose from a mistaken rendering of the word "peripatetic."

has a fixed habitation. Rather does the movement at first sight suggest a feature characteristic of mountains wherein the mountaineer makes periodic excursions to the lower country to supplement the scant resources of his native land, as for example the annual excursions of the Italian glaziers of the Piedmont to pursue their calling in itinerant fashion along the roads of France.²⁵ For such a movement there is a very distinct economic justification, but it is unusual in the Andes, where the Indian is remarkably "fixed." The shepherd may cover an immense area in the pasturing of his flocks, but he is none the less bound to his stone hut and potato patch; the agriculturist may, as in the valleys of Carabaya, possess lands in the hot valley a considerable distance from his home, but he has no tendency to move farther afield. In some instances, and oftener now than formerly, the Indian will voluntarily seek service in the *haciendas* of the white cultivators or even in the mines, but this is not general. This long-established fixity of the Indian is a fact of deep significance. On that foundation was built the ancient Andean civilization. Under the given physical circumstances it is difficult to conceive of so highly perfected an agricultural régime being achieved by any other means.²⁶

The elaborate schemes of terracing and irrigation in the steep-walled valleys involved great and constant labor and concerted and directed action. Government was naturally some form of autocracy; individual liberty was necessarily sacrificed to the common good, as is clearly shown by the laws of the Incas. Any man who tried to change his apportioned work in the province to which he was native "committed a very great crime against the Inca, against his nation, and against his native province; and so he was condemned by all and punished with severity."²⁷ No man could change his residence without license, and the *mitimaes*, the involuntary colonists, who were the individuals most likely to disobey this rule, were most severely punished for any attempt to leave the land of their exile. In the pastoral industry also a rigorous régime was enforced. Careful demarcation of the pasture grounds as well as antiquity of domestication is revealed in the remarkable diversity of color among the native flocks. In accord with this social system the work of subordinate occupations was also apportioned; "different provinces of the country furnished persons peculiarly suited to different employments, which . . . usually descended from father to son."²⁸ Higher in the social scale the "professions," science, war, administration, fell into the same scheme. It is in this traditional character of industry under the Inca Empire that we may find the clue to that of the Callahuaya.

Some idea of the status of ancient Peruvian medicine may be gathered from the pages of the early chronicles. In them, so far as is known, the

²⁵ Reclus suggests this in regard to the Callahuayas, in "L'Homme et la terre," Vol. 1, p. 71. 1905.

²⁶ The fundamental place of agriculture in the old Peruvian civilization has been emphasized by nearly all writers on the theme. For one of the latest expositions see "Staircase Farms of the Ancients," by O. F. Cook, *Natl. Geogr. Mag.*, Vol. 29, 1916, pp. 474-534.

²⁷ P. B. Cobo: *Historia del Nuevo Mundo*, Vol. 3, Seville, 1892, p. 240.

²⁸ W. H. Prescott: *The Conquest of Peru*, 2 vols., New York, 1847; reference in Vol. 1, p. 55.

Callahuayas are not referred to by name, but there are various references to exponents of the medical art in general. Acosta says that in the times of the "Kings Incas of Cusco" there were persons "expert in the curing of diseases with simples"; and they had knowledge of the many "virtues and properties of herbs, roots, woods, and plants."²⁹ Garcilaso also states that herbalists were famous in the times of the Incas ("they knew the use of many herbs and taught their knowledge to their children"), and further quotes a dictum of the wise Inca Pachacutec from the chronicles of Father Blas Valera: "The physician herbalist that is ignorant of the virtues of herbs, or who, knowing the use of some, has not attained a knowledge of all, understands little or nothing. He ought to work until he knows all, as well the useful as the injurious plants, in order to deserve the name he pretends to."³⁰ Cobo says the natives had very little medical knowledge: they were most expert in the healing of wounds by use of "extraordinary herbs of very great virtue." In their cures sorcery and witchcraft invariably played a part.³¹

The relation of the Callahuaya to the other tribes of the Empire remains to be shown. According to Bandelier he is a Quechua-speaking Indian, and the peculiar unstudied language, also spoken by the Callahuaya of today, is probably no more than a dialect with an added jargon of words appropriate to his mysterious calling. It is used only by the Callahuayas among themselves; outsiders are not supposed to hear it. At Pelechuco Bandelier learned the first ten numerals of the so-called Callahuaya language. They are: *mayti* (one), *payti* (two), *iriti* (three), *yumqui* (four), *taquili* (five), *tacsu* (six), *chianan* (seven), *richaj* (eight), *chipana* (nine), *kolke* (ten). The numbers one and two are clearly derived from the Aymará *maya* and *paya*.

Among the Callahuayas local tradition has it that they were transported as *mitimaes* from the village of Carabaya (or Callavaya or Collahuaya as the name commonly appears in the earlier spelling).³² According to Garcilaso de la Vega the Inca Sinchi Roca conquered as far as the river called Collahuaya, and under Ccapac Yupanqui the kingdom stretched to Callahuaya, 40 leagues from Cuzco. Certain it is that the Incas made conquests into the coca- and gold-producing lands of the *montaña*.

Here the precise location of Curva becomes significant. It is at the head of one of the Camata valleys, and Camata was one of the gateways into the *montaña*. Today the remains of an Inca road can be traced along the valley far down toward the Amazonian plains. At Incahuara on the Rio Caca, to

²⁹ Joseph de Acosta: *Natural and Moral History of the Indies*, Vol. 1, *Hakluyt Soc. Publs.*, 1st Ser., No. 60, 1880; reference in Bk 4, Ch. 29.

³⁰ Garcilaso de la Vega: *Royal Commentaries of the Yncas*, Vol. 1, *Hakluyt Soc. Publs.*, 1st Ser., No. 41, 1869, Bk. 2, Ch. 24; *Ibid.*, Vol. 2, 1st Ser., No. 45, 1871, Bk. 6, Ch. 36.

³¹ P. B. Cobo, *op. cit.*, Vol. 4, Ch. 10.

³² Adolfo Ascarrunz (*op. cit.*, p. 42) derives the folk-name Callahuaya from two Aymará words—*calla*, a carrying, and *guayu*, a bundle of clothing, referring to the bundles they carry in their knapsacks. The place connection, however, makes this seem unnecessary.

which the Camata is tributary and which itself unites with the Beni, there are sun and moon carvings on the rocks. Early in colonial times there were four recognized routes for the penetration of a vast stretch of *montaña*. These were (1) by Opatari and the Andes of Tono in latitude 13°; (2) by San Juan del Oro, down one of the valleys of Caravaya; (3) by Camata; and (4) by Cochabamba, latitude 17° 30'. These four entrances are repeatedly mentioned in the documents relating to Juan Alvarez Maldonado, one of the first Spaniards definitely to undertake the conquest of this portion of the *montaña*. His rival, Gomez Tordoya, selecting the route through Camata to forestall the authorized "conqueror," was pursued by the law as far as Charasani. The Jesuit missionaries also made early entry to the "Chunchos" via Camata. Camata and Pelehuco are described as frontiers of the civilized Christian Indians against the savage Chunchos. Camata town itself was long on the actual frontier. Its ancient houses were built of stone and constructed in a manner suitable for defence to resist invasions of the town by the Lecos of the Mapiri.³³ Now it is this old-debated territory of the *montaña* that furnishes the valuable medicinal plants.³⁴ A people situated near the border country with relatively easy access to sources of supply would naturally be selected to act as purveyors of the medicinal plants of the *montaña*. The ancient origin of the profession of the Callahuayas of Curva is at least plausible.

The event of the Spanish conquest would motive no change in a group so small and comparatively remote. Though it broke down the elaborate social fabric, it left the great body of Indians fundamentally unchanged in attitude. Furthermore the Spaniards of the early colonial days were a superstitious people of a superstitious age, and scientific knowledge was scant among them. In 1637 the proposal to found chairs of medicine in the University of Lima was opposed on the ground that "in this kingdom there are many medicinal herbs, for a great variety of diseases and hurts with which the Indians are better acquainted than the physicians . . . ; many persons, when given over by the faculty, set out for Cercado and Surco [near Lima] to be cured by Indian men and women." Even in the nineteenth century General Miller wrote: "In all the provinces of the department of Puno not one regular medical man is known to exist. The aboriginal tribe of Callahuayas or Yungeños are the only practitioners throughout a great part of South America."³⁵ It is in the light of a survival that the Callahuaya has the greatest claim on our interest today. He reminds us of the strength of the old geographical controls that rule in the Central Andes. He is entirely in harmony with the unchanged life of the highland shepherd,

³³ Rigoberto Parades, *op. cit.* in footnote 9.

³⁴ To the Indian inhabitants is commonly attributed an extensive empirical knowledge of their properties. Wiener speaks of the Piro of the Urubamba valley who annually ascend to Hillipani to exchange woven goods, pottery, live birds, and certain medicinal plants of which these "Chunchos" have more knowledge than the Quechua Indian.

³⁵ *Op. cit.* in footnote 3.

still offering his sacrifices to Pachamama and indifferently mingling prayers to the saints with prayers to the Earth-Mother.³⁶ He is in sympathy with an agriculture whose products are almost wholly for local consumption, as is the case with all but the largest *haciendas* of the eastern valleys, the major basins of the plateau, and the accessible coast valleys.³⁷ He is a part of that system of exchange still carried on largely by weekly or yearly fairs because regular means of transportation are so little developed. The fairs indeed contribute largely to the Callahuaya's custom; at them among the ordinary types of mountebank he figures as "an unconfoundable type."³⁸

³⁶ For example: "Mamita Santa Ana, tejer, hilar, Madre de las hilanderas y de las tejedoras: Que sea con tus manos, Pachamama." (Éric Boman: *Antiquités de la Région Andine*, Vol. 2, p. 490.)

³⁷ Isaiah Bowman: *The Andes of Southern Peru*, New York, 1916, Chs. 6, 7.

³⁸ Ciro Bayo: *El Peregrino en Indias*, 1911, p. 32.

ISLAND NANTUCKET

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For three hundred years, or perhaps longer, Nantucket peoples have lived isolated from the mainland. While protective, this isolation, when extreme, has impoverished the inhabitants; but it has been helpful as long as there was an easy exchange of commodities and ideas with "off-islanders." The limitations of small area and infertility have always strengthened these continental ties.

The Indians, as is shown by their primitive retardation, apparently had little contact with the mainland. "The Indians of Nantucket were a people who were destitute of most of the arts of life. They were acquainted with roasting, but not with boiling. Though they had all the materials on the shore, yet they could not, like the Narragansets, coin wompomeag. They cultivated no plants, except maize, beans, squashes, and tobacco. To each family was assigned a portion of land, equal to about a quarter of an acre, which they broke up as well as they could with the rude tools that they possessed, called in their language *mattoks*, assisting each other in a very friendly manner. They could now and then kill a bird; and there were a few deer: goat skins, but not the animal itself, were found by the English on the island. Fish could be obtained in the harbors and on the coast; and shellfish were abundant (berries too). During the winter, however, they frequently suffered the extremities of famine. Their clothes were sometimes skins, but for the most part coarse mats, made of grass."¹ Obed Macy in his valuable book, "The History of Nantucket,"² says: "The natives fished with a rude line of twisted grass, to which they attached a large stone (two or three pounds) for a sinker and a clumsy hook of bone." They killed whales, also, engaging the whale with a harpoon attached to a long bark rope and dispatching him with arrows.³ Thus the Indians were able to respond to the stimulation of their ocean environment.

Their life was set on and about a low, mostly sandy island of 45 square miles with shore lines smoothed and points projected by the cutting and building action of waves and currents. Nantucket is some 28 miles south of Cape Cod and is surrounded by a large area of shoals, many of which are of sand washed from the island (map, Fig. 1). Climatically, Nantucket is more continental than marine: in winter the prevailing northwest winds

¹ *Massachusetts Hist. Soc., Colls.*, 2nd Ser., Vol. 3, 1815, p. 35.

² Boston, 300 pp., 1835.

³ R. A. Douglas-Lithgow: *Nantucket: A History*, 389 pp., New York, 1914; reference on p. 47.

come from a cold continent, but in summer the southerly winds pass a long distance over the mild ocean. Winds from the northeast at any time of the year carry the suggestion of the cold Labrador Current. In winter, an intense cyclone sweeping up the coast brings its gales and at times a smothering snowstorm; in late summer and autumn a West Indian hurricane with its tremendous winds and waves may blow and wash away some of the island.⁴

Such were the surroundings to which the first civilized settlers came in 1659. Here for a century was the bustling home port of American pioneer whalers. And now here is the quiet summer resort of thousands of New Englanders. The nine original share-holders bought the right to the island and gradually paid the Indians for their land. The Indians, always friendly, were indispensable in helping the newcomers build their houses, clear the land, raise the crops, fish, and finally carry on whaling. With the introduction of sheep, for which the island is eminently fitted, the colonists had a great advantage over the Indians' mode of life. The mutton, wool, perhaps some fish, and sometimes even grain enabled them to trade with the people on the mainland. To enlarge and complete the new colony the original purchasers took partners and offered half-shares (54ths) in the island to artisans and trades-people.⁵ The white man was able to teach the Indian how to make more effective use of his resources, but he more than offset this by introducing habits and diseases which finally exterminated the primitive hunter and fisher.

The many whales within sight of the island inevitably attracted attention. While the land was poor, the sea was extraordinarily rich. Shore, and then pelagic, whaling broadened the environment of the inhabitants till a Nantucket population was supported three times as great as the present (see Fig. 2). Crèveœur, in his description of pre-Revolutionary Nantucket, calls it, "a barren sandbank, fertilized with whale oil only."⁶ Two thousand men were getting the whales, while the rest were making boats and outfitting

⁴ Much interesting information about the changes of the shore lines is given by F. P. Gulliver: Nantucket Shorelines, *Bull. Geol. Soc. of America*, Vol. 15, 1904, pp. 507-522. A comparison of Nantucket outlines as shown on a progressive series of U. S. Coast and Geodetic Survey charts and on the following maps is also instructive:

Island of Nantucket, 1:220,000, drawn by William Coffin for Macy's "History of Nantucket."

Map of Nantucket, 1:127,000, surveyed and drawn by F. C. Ewer. 1869.

Nantucket quadrangle and Muskeget sheet, 1:62,500, surveyed by the U. S. Geol. Survey and the State of Massachusetts, U. S. Geol. Survey. 1887.

Nantucket County, Massachusetts, 1:95,000, surveyed and drawn by J. H. Robinson. Accompanies J. H. Robinson's "Guide to Nantucket." 40 pp., 2nd edit., 1910.

Nantucket and the Surrounding Shoals, 1:250,000. Accompanies A. H. Gardner's "Wrecks about Nantucket, 1664-1915," 149 pp., Nantucket, 2nd edit., 1915. Based on U. S. Coast and Geodetic Chart No. 111, 1915. Nantucket Sound, 1:80,000.

⁵ One joiner, miller and interpreter; one shoemaker; one shoemaker and blacksmith; one tailor; one weaver; five seamen.

From H. B. Worth: Nantucket Lands and Landowners," Vol. 2, 216 pp., Nantucket Historical Assoc., Nantucket, 1901-1904. A source-book of Nantucket history containing extensive quotations from town, and other records.

⁶ M. G. St. Jean de Crèveœur: Letters from an American Farmer, 355 pp., London, 1782, reprinted, New York, 1904. Pp. 119-221 in the reprint relate to Nantucket; reference on p. 179.

them, making spermaceti candles, and supplying the people with food, fuel, and manufactured goods.⁷

"The Story of Old [and new] Nantucket" has been told so well by William F. Macy⁸ and others that it need here be traced only in a general way. With Miss Ellen C. Semple's chapter on "Island Peoples"⁹ as a



FIG. 1—Map of Nantucket.

background, this discussion will be confined chiefly to the effects of isolation on the constituent elements, character, and life of the people, and to the effects of small area on the economic development, density of population, and emigration. The original settlers were well fitted to be pioneers of American whaling. They were doubly selected: they seem to have been among the hardest of those progressive people who for economic or religious reasons

⁷ Douglas-Lithgow, *op. cit.*, pp. 346-347, gives the details of the home industries.

⁸ 108 pp., Nantucket, 1915.

⁹ *Influences of Geographic Environment*, 683 pp., New York, 1911.

came to America; for who else would move to a rather isolated, sandy island after having settled on the New England mainland? As the Indian population waned and whaling increased, more people were drawn from the mainland and crews were filled at the Azores and the Pacific islands and coasts. Furthermore, not infrequently, shipwrecked sailors found in Nantucket a welcome home. Thus in the last decade of Nantucket whaling, Marthas Vineyard was less cosmopolitan than Nantucket; but now, with the fishing and agricultural basis of these communities, the foreign-born element in both exceeds ten per cent (see Table I). The colored element in

TABLE I.—NUMBER AND ORIGIN OF THE FOREIGN-BORN POPULATION OF NANTUCKET AND MARTHAS VINEYARD, 1860-1910

	IRELAND		ATLANTIC ISLANDS		PORTUGAL		GREAT BRITAIN		CANADA		TOTAL	
	N.	M. V.	N.	M. V.	N.	M. V.	N.	M. V.	N.	M. V.	N.	M. V.
1860.....	...	..	...	...	...	...	...	...	...	...	292	191
1870.....	103	24	39	39	1	0	17	21	16	5	202	105
1880.....	112	27	41	11	0	0	11	61	4	17	192	201
1890.....	104	42	50	86	0	136	22	45	31	77	235	449
1900.....	84	62	0	299	69	79	44	71	32	77	267	645
1910.....	62	36	0	192	210	220	50	59	59	94	418	642

the population has always remained small (see Fig. 2). English nobles and artisans, French Huguenots, Scotch, some Dutch, and "Americans" merged into Nantucketers, an island people. Judging by surnames, in 1790 the white population of 4,521 was composed of 4,426 English and Welsh, 62 Scotch, and 33 Irish.¹⁰

Of the descendants of these people, Douglas-Lithgow says:¹¹ ". . . generally segregated from the outside world as they have long been in an insular environment, they have lived like one large family, in which the peculiarities of the original stock have been bred in and in without much external variation. They have developed, therefore, into a people capable of being distinguished by certain characteristics which are apparent to every off-islander during five-minutes' conversation." The life and customs of these people up to the middle of the eighteenth century are shown in interesting detail by William R. Bliss in his "Quaint Nantucket."¹² The town-crier custom survived in Nantucket until 1909.

The curious mixture of conservative and radical tendencies also may be ascribed to isolation. Thus, home improvements such as street-paving and water-works met with years of opposition from the townspeople;¹³ but the

¹⁰ "A Century of Population Growth in the United States, 1790 to 1900," 303 pp., Bureau of the Census, Washington, D. C., 1909.

The origins of the surnames found on the island are discussed by Miss Helen A. Gardner: Our Debt to the Huguenots, *Proc. Nantucket Hist. Assoc. 16th Ann. Meeting*, 1910, pp. 43-49.

¹¹ *Op. cit.*, p. 303.

¹² 225 pp., Boston, 1896; 2nd edit., 1897.

¹³ See "Nantucket Town Meeting," by A. H. Gardner, on pp. 185-188 of "Sea-girt Nantucket," compiled by H. S. Wyer, 202 pp., Nantucket, 1902; also Bliss, *op. cit.*, 1st edit., pp. 176-191. "Sea-girt Nantucket" is an interesting and comprehensive compilation of articles written by many people. "Spun Yarn from Old Nantucket," edited by H. S. Wyer, 311 pp., Nantucket, 1914, is a book of well-selected readings on Nantucket life.

same men had explored in all the oceans. Nantucketers were the first to have specific knowledge of the Gulf Stream off the North Atlantic coast, and one of them was the first to map it¹⁴; also they discovered most of the important whaling banks and a large number of Pacific islands. They traded with distant ports, even with Canton, China, taking thither whale oil, sperm candles, Madeira wine, hard soap, and Spanish dollars at first, and later, sealskins in great quantities. The development of Quakerism as the dominant religion of the place in the eighteenth and nineteenth centuries is another example of the radical tendency fostered by island freedom from oppression.

The effect of limited area on insular history was never more clearly shown than during the Revolution and the War of 1812. Nantucket was always at the mercy of the sea-faring enemy, for the people could not resist the force of his superior numbers; nor did they dare to run the chance of famine from a complete blockade. The returns from the re-established fishing, amounting probably to less than 2,000 barrels,¹⁵ and farming with a grain yield of less than 11,000 bushels in 1778, were insufficient. By remaining neutral, the inhabitants survived without being seriously plundered, and even obtained dispensations for Quaker sailors to procure wood and food from the mainland. Quaker frugality and non-resistance exactly suited

¹⁴ See Alexander Starbuck: *History of the American Whale Fishery from Its Earliest Inception to the Year 1876*, Appendix A of *Rept. of the Commissioner of Fish and Fisheries for 1875-1876*, pp. 1-779, Washington, D. C., 1878; reference on pp. 55-56. This is a comprehensive account, accompanied by a large number of tables; it is one of the foundation stones of Nantucket history.

[The story of how this knowledge of the Gulf Stream came to light is not without dramatic interest. In 1769 the port authorities of Boston submitted a complaint to the Lords of the Treasury in London stating that on their westward voyages the English packets from Falmouth took something like fourteen days longer to reach New York than did the Rhode Island merchantmen to reach Narragansett Bay, and that a change of destination might therefore be advisable. Benjamin Franklin, being at the time in London as deputy postmaster-general of the colonies, was consulted. He sought the opinion of a Nantucket captain, Timothy (?) Folger, who was in London at the time. Captain Folger told him that the merchantmen were commanded by men from Nantucket who, from their whaling voyages, were well acquainted with the Gulf Stream, its course, strength, and extent and utilized their knowledge by laying their westward courses inshore, north of the Gulf Stream, thus avoiding the retarding influence of its current. The English captains had often been told of these conditions, but did not think it worth while to pay attention to what simple American fishermen had to say. Immediately on hearing this Franklin requested Captain Folger to lay down the course of the Gulf Stream on a chart. This information Franklin caused to be engraved on the old chart issued by the authorities in London (published "at Mount and Page's, Tower Hill"). He had copies of the new chart distributed among the Falmouth captains, but they persisted in sailing their old course. As the difficulties with the mother country were coming to a head, he did not urge the matter further and only after the Revolutionary War was over gave it wider currency by publishing it in the *Transactions of the American Philosophical Society of Philadelphia* (Vol. 2, 1786). See also Franklin's "Works," edited by ———, 1800, Vol. 3, pp. 353 and 364 (referred to by Starbuck); Governor Pownall: *Hydraulic and Nautical Observations on the Currents in the Atlantic Ocean*, with a corresponding chart of that ocean, to which are annexed some notes by Dr. Franklin, London, 1787; and J. G. Kohl: *Aeltere Geschichte der Atlantischen Strömungen und namentlich des Golfstromes bis auf Benjamin Franklin*, *Zeitschr. für allgemeine Erdkunde* (Berlin), Vol. 11, 1861, pp. 305-341 and 385-446, reference on pp. 436-441 (originally written in English in 1858 for publication by the U. S. Coast Survey, but never published in that form). Facsimiles of Franklin's map appear in (1) J. G. Kohl: *Geschichte des Golfstromes und seiner Erforschung von den ältesten Zeiten bis auf den grossen amerikanischen Bürgerkrieg*, Bremen, 1868, opp. p. 108; (2) Ludwig Mecking: *Der Golfstrom in seiner historischen, nautischen, und klimatischen Bedeutung*, *Meereskunde: Sammlung volkstümlicher Vorträge* No. 51, 1911, p. 15; and (3) Gerhard Schott: *Geographie des Atlantischen Ozeans*, Hamburg, 1912, p. 25 (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 378-380).—EDIT. NOTE.]

¹⁵ *Mass. Hist. Soc.*, 2nd Ser., Vol. 3, 1815, pp. 20 and 23.

the environment. Bliss¹⁶ quotes from the journal of Thomas Chaulkley, a Quaker minister who visited Nantucket in 1737: "The people live in such a way that lawyers who plead for money, and doctors who prescribe for money, and preachers who preach for money have no employment on the island."

The economic limitation of a small island such as Nantucket is soon reached. The trees were quickly destroyed and the people became dependent on external sources for fuel and lumber. Undesirable animals, except the Indians' dogs, apparently were exterminated early; yet there is no lack of hunting, for there are myriads of migrating or wintering waterfowls.

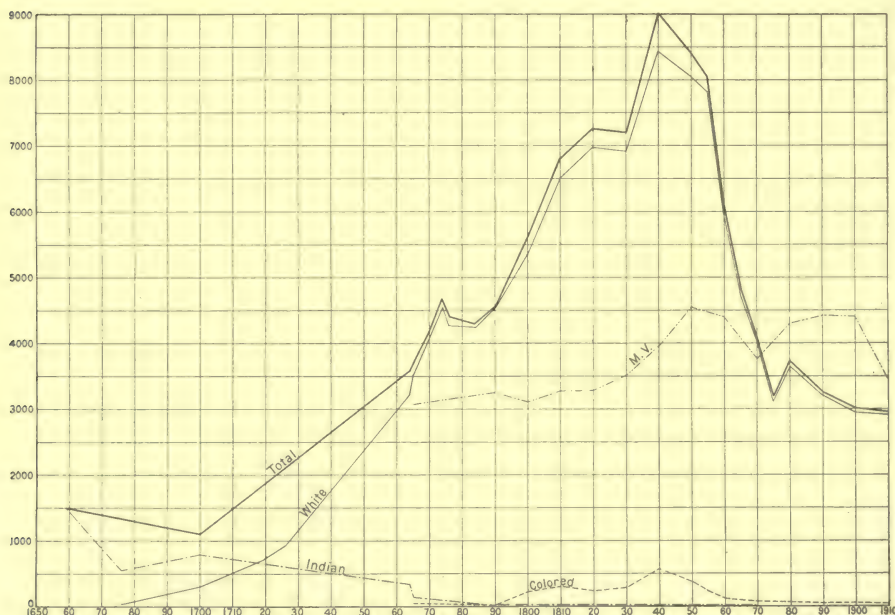


FIG. 2—Nantucket population. The curve marked M. V. represents the population of Martha's Vineyard. Sources: Obed Macy and Bliss for earlier years; national and state census reports for later years.

Agriculturally, Nantucket is not favored. Soon after the Europeans arrived, the area tilled reached a maximum which since has not been surpassed (see Table II), unless perhaps during the decline in whaling when the men turned to the land for support (1850 to 1870).

At best the yields were low, so farming gave way to the more lucrative whaling industry, leaving still the sheep-raising, which required a minimum amount of labor. As an offset to the poorness of the land, the richness of the sea is of great value. The great area of shoals in the vicinity has an apparently inexhaustible supply of sea food,¹⁷ and quahaugs, flounders,

¹⁶ *Op. cit.*, 1st edit., p. 98.

¹⁷ Dr. G. W. Field of the Massachusetts Commission on Fisheries and Game has said that "this vast expanse of shallows outside the three-mile limit to the edge of the continental plateau is a submarine plain, richer even than the Mississippi Valley in potential capacity for producing human food. . . .". *Science*, N. S., Vol. 44, 1916, p. 227.

TABLE II—NANTUCKET FARMING

YEAR	NUMBER OF FARMS	ACRES OF LAND IN FARMS		POTATOES		MAIZE		OATS		RYE, WHEAT, AND BARLEY		HAY tons	SHEEP AND GOATS	CATTLE
		imprvd	unimpr.	acres	bushels	acres	bushels	acres	bushels	acres	bushels			
Early 18th C.*	..	....	....	....	....	875*	12,100*	680*	10,000*	95*	600*	....	....	...
1775*...	..	....	....	....	....	....	....	....	....	..	....	....	15,000*	...
1778....	..	1,836	....	....	....	....	....	....	....	..	....	....	9,938	749
1784....	..	....	....	....	....	....	....	....	....	..	....	....	3,000	693
1800....	..	2,042	3,360*	....	....	....	....	....	....	..	....	652 acres	....	....
1810....	..	....	....	....	....	....	....	....	....	..	....	....	10,000*	520
1850....	58	3,792	4,265	....	5,997	....	3,206	....	972	..	1,289	1,439	977	597
1860....	124	6,763	6,382	....	5,129	....	8,709	....	1,005	..	1,141	2,440	1,077	835
1870....	105	4,062	7,147	....	7,424	....	7,921	....	2,045	..	997	2,177	1,219	809
1880....	87	5,805	13,676	68	5,310	214	3,108	11	216	0	0	1,214	1,376	666
1890....	36	1,485	1,187	33	2,802	64	2,501	21	0	0	0	610	412	258
1900....	54	2,026	2,051	....	....	....	....	....	....	..	....	....	....	....
1910....	24	1,250	1,859	24	3,185	45	1,988	10	300	3	45	672	243	560

* Figures uncertain. Data prior to 1850 were gleaned from various Nantucket books; after 1850 figures are from the U. S. Census reports.

scallops, cod, and haddock have made the fishing industry of the island very prosperous of recent years.

During the height of whaling, agriculture dwindled under the labor competition of manufacturing. Also, sheep-raising on the commons ended,

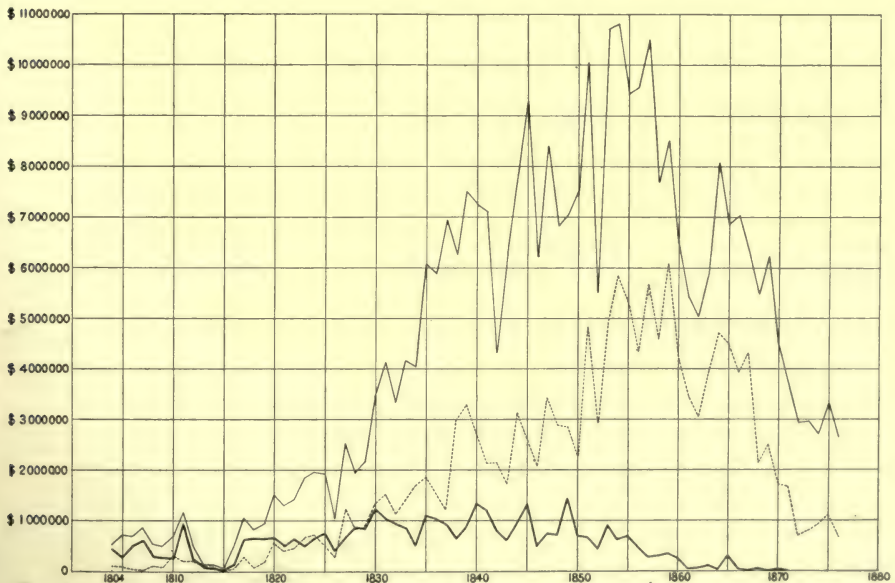


FIG. 3—Value of whale imports, including whale oil, sperm oil, and whalebone, 1804-1876. The uppermost curve represents imports for the United States; the dotted curve, New Bedford; the heavy lowermost curve, Nantucket. Sources: Starbuck and Obed Macy.

for some of the people illegitimately overstocked the range, and unconfined sheep became a nuisance; competition of western mutton and ravages of sheep-killing dogs also contributed to the decline. With the passing of the whaling industry fishing became an important means of livelihood, as when

whaling practically ceased during the Revolution and War of 1812. Then, too, the very shoals which are so valuable in fish also have yielded a sporadic but profitable winter wrecking business for some of the islanders. "During the fiscal year ending 1900, property valued at seven and one-quarter million was recovered from nine and one-half million imperiled, while only 48 lives were lost and 2,607 rescued."¹⁸

Isolation, formerly helpful, became excessive. As whales grew scarce, larger ships were needed to go on the two to four years' voyages to the Pacific; but the harbor was too shallow for them. Whereas, prior to 1831 but 10 out of 134 wrecks in the vicinity of Nantucket occurred on the bar, from 1831 to 1850, 33 out of 161 Nantucket wrecks occurred there.¹⁹ The harbor made by a wave-built spit was limited in its usefulness by a wave-made bar. With this New Bedford on the mainland rose to the first place as a whaling port (see Fig. 3), for New Bedford is near Nantucket and has a good harbor.²⁰ The increasing cost of ships, a million-dollar fire (1846), the California gold rush, the discovery of petroleum (1859), and the Civil War quickly put an end to Nantucket whaling (see Fig. 3).²¹ Even with a belated jetty channel begun in 1881, industries and trade have not been attracted by cheap labor and low rents, for raw materials and markets are too distant and storms and ice-blockades may for six weeks in winter prevent exchange with the mainland.²²

With the changing effects of isolation and the concomitant changes in the economic control of a small area, the population has altered greatly (see Fig. 2). Until fifty years ago the density of Nantucket population was greater than that of the neighboring mainland. With probably 1,500 Indians²³ in the middle of the seventeenth century the density was about 30 per square mile. An equal density on the neighboring mainland would have called for a concentration of all the former Indian population of the United States into Massachusetts, Rhode Island and Connecticut.²⁴ This relatively great density seems to have been due to (1) the food area being greater than the land area; (2) isolation, which freed the Indians from outside attack and perhaps from epidemics; (3) lack of internal wars after the close contact of the tribes had forced them to draw a boundary line; (4) difficulty of emigration. In 1840, Nantucket's population density of 200 per square mile compared favorably with the corresponding figures: 80 in Barnstable County, 37 in Dukes County (Marthas Vineyard), and 83

¹⁸ "Sea-girt Nantucket," p. 117. See also Gardner's "Wrecks about Nantucket."

¹⁹ Compiled from Gardner's "Wrecks about Nantucket."

²⁰ W. S. Tower: *A History of the American Whale Fishery*, *Publ. of the Univ. of Pennsylvania: Series in Political Economy and Public Law No. 20*, 145 pp., Philadelphia, 1907. This book is apparently the best account of American whaling in its many aspects. It forms an excellent background for any study of Nantucket.

²¹ *Op. cit.*, pp. 66-79, considers the causes of the general decline.

²² See Bliss, *op. cit.*, 1st edit., p. 216, and Nantucket Weather Bureau records.

²³ Obed Macy, *op. cit.*, p. 17.

²⁴ Mr. J. Mooney estimates the former Indian population of the United States to have been 860,000. See *Science*, N. S., Vol. 43, 1916, p. 826.

in Massachusetts, Connecticut, and Rhode Island together. This density was due primarily to the whaling interests, but, as a focal location for trade, Nantucket also claimed many who were not engaged in whaling. For example, in 1821 of a total tonnage of 27,496 belonging to Nantucket, 23,213 was engaged in whaling, 3,885 in coasting, 352 in foreign trade, and 43 in cod-fishing.²⁵ Nantucket's present (1910) density of population of 67, which in summer is trebled, is far behind the 350 per square mile in industrial southern New England.

As is usually the case with islands, the population increased more rapidly than the development of the resources, and emigration resulted. Nantucket

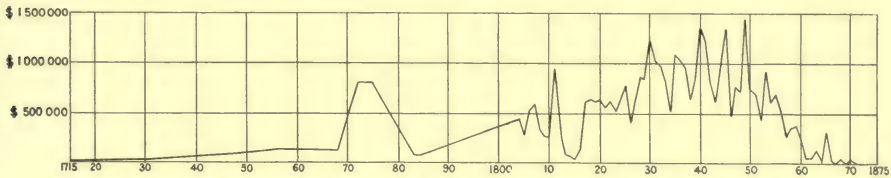


FIG. 4—Nantucket whale imports from the earliest records to 1875.

has sent its people to all parts of the world. Many men became masters sailing from other ports; Nantucketers built the whaling business in many American, Canadian, British, French, and even Chilean ports. Some colonial groups kept their home ties and in this way helped Nantucket trade. The New Garden colony in North Carolina sent out tobacco, foodstuffs, and naval stores; one on the Kennebec, in Maine, supplied lumber and food. Emigration occurred in waves according to the economic condition at home and to the possibilities elsewhere. Frequent over-supplies of oil (see the variation in the whale-products curves, Fig. 3), foreign bounties or tariffs, or loss of ships were the cause of numerous depressions.²⁶ While the Revolutionary War was threatening, emigration was stimulated. During the war, few could leave the island; but in the years of economic depression after the war many moved away, some to become farmers, others to be whalers from enticing foreign ports. Similarly, in the first two decades of the nineteenth century there was considerable emigration. After the destructive fire of 1846, at a time when the whaling business was becoming unprofitable, the discovery of gold in California is said to have drawn off 1,000 of Nantucket's people in three years. Emigration continued apace, especially after the panic of 1857, as Nantucket declined to the virtual death of her commerce and industry. The preponderance of young men in 1850 changed to a dearth in 1860 (see Table III). Of the 1,878 males 10 to 29 years of age in 1850, apparently 721 left Nantucket in the decade—30 per cent of all the emigrants! Marthas Vineyard, on the other hand, had an accession of 152 males of 20-29 years in 1860 as compared with 1850, for Edgartown

²⁵ Obed Macy, *op. cit.*, p. 216. See also pp. 51 and 138 for information about trade.

²⁶ *Ibid.*, pp. 50 *et seq.*

TABLE III.—NANTUCKET POPULATION CLASSIFIED BY COLOR, SEX, AND AGE, 1850 AND 1860

	AGES									TOTAL
	0-14	15-19	20-29	30-39	40-49	50-59	60-69	over 70	Unknown	
WHITES										
1850										
Male.....	1,239	436	896	555	420	268	194	111	0	4,119
Female.....	1,274	346	610	532	424	322	229	201	1	3,939
1860										
Male.....	833	274	361	295	339	264	225	146	0	2,737
Female.....	796	332	507	411	372	337	265	209	0	3,229
COLORED										
1850										
Male.....	39	20	127	40	24	14	6	2	0	272
Female.....	27	15	24	20	15	15	1	5	0	122
1860										
Male.....	13	9	9	6	6	8	3	1	0	55
Female.....	15	8	8	9	12	10	7	4	0	73
CHANGE 1850-1860										
Male.....	-432	-173	-653	-294	-99	-10	+28	+34	...	-1,599
Female.....	-490	-21	-119	-132	-55	+10	+42	+7	-1	-759

with its better harbor had fallen heir to some of Nantucket's whaling. Even though in the seventies the coming of the summer people softened the decline, the young and energetic still left the island, so that in the eighties—and perhaps it is true today—Nantucket claimed to be the “healthiest town in Massachusetts” because the age at death of so large a proportion exceeded 70 years (35 out of 75 in 1880).²⁷ The population has apparently become stable now, for the great preponderance of females over males which has existed since the fifties is rapidly disappearing: the 1,299 males in 1900 increased to 1,361 by 1910; but the 1,707 females changed to 1,601 in the same decade. Thus the difference, which was 408 in 1900 and 240 in 1910, may point to a tendency toward revival in the economic status of Nantucket.

On account of their isolation the primitive Indians, as has been said, showed some retardation in development. On the other hand, the civilized Europeans found the environment very favorable to the evolution of a distinct society untrammelled by the strifes of the mainland peoples. Though progressive in whaling, Nantucketers became conservative in home affairs. Their language became a nautical dialect; and old customs long survived the day when progress eliminated them on the continent. The very isolation which favored Nantucket's development well into the nineteenth century, brought impoverishment when conditions for the prosecution of whaling and trade became more favorable in continental ports.

The ocean environment which led to the fishing and whaling industries saved the fortunes of the people who remained after the whaling days. Nantucket became a thriving summer resort (it has some 10,000 summer visitors now). The summers are relatively cool; there is plentiful fishing; surf is high; the water is warm; and, as a whole, Nantucket is a quiet distant place with scenery unlike the rest of New England. In winter, some duck hunters and the quahaug dredgers break the monotony.

²⁷ E. K. Godfrey: *The Island of Nantucket, etc.*, 365 pp., Boston, 1882; reference on pp. 277-278. A comprehensive guide-book with the items arranged alphabetically.

When will farming again come into its own? The island Nantucket has little to offer except a good climate; the soil, poor for tilling, supports a dense dwarf vegetation and has shown itself well fitted for sheep-raising. The shoals and ponds yield abundant fish and attract numerous waterfowls. Some 300 acres of the swamps are used for a new and thriving cranberry industry. A unit of 240 acres with 35 miles of canals is said to be the largest cultivated cranberry bog in the world. Most of the pickers are Portuguese negroes. High winds, cool nights, much fog, and lack of easily available fertilizer may hinder agriculture, but it is apparently the indifference of the people which is chiefly to blame for the annual importation of about \$200,000 worth of farm produce while the countryside lies idle. Sheep-raising and dairying combined with truck-farming could thrive on the local market alone. For fertilizer there is plenty of lime (shells), peat, and kelp. Some of the summer truck-gardeners might copy profitably the seasonal migration of the hotel workers and part of the trades-people, and live on the mainland in winter. The future of the island may be full of promise; but now, on seeing the miles and miles of unused land, covered mostly with scrub oak or other low plants, one gets an overpowering feeling that Nantucket is a land of wasted opportunity.

THE RÔLE OF POLITICAL BOUNDARIES

By DOUGLAS W. JOHNSON

Boundary disputes have ever been potent causes of war. A treaty of peace not infrequently constitutes the *casus belli* of a new conflagration, because it imposes upon some belligerent illogical and geographically impossible boundaries. The first shot of the second Balkan war was fired during peace negotiations at the close of the first; and the treaty of peace which terminated the second conflict laid the basis for Bulgaria's last assault on Serbia. In each case a political boundary which deprived Bulgaria of certain real or fancied geographical advantages was the cause of war. Italy rejected Austrian tenders of territory and entered the present war against her former ally because the latter would not agree to a boundary designed to secure Italy against invasion from the north.

Manifestly anything so pregnant with dangerous possibilities as a political boundary demands careful study. Not until the rôle which a boundary line should play in the economy of nations is fully understood will it be proper to seek the ideal boundary line. Not until the comparative value of different physical features on the earth's surface in performing the desired rôle has been determined will it be possible to say which natural boundaries are best. The geographer is always profoundly interested in any discussions bearing on these vital points and particularly so at a time when such discussions have more than ordinary significance in view of the new map of Europe which must soon be drawn. A brief review of four recent papers dealing with boundary problems, two from the standpoint of general principles and two relating to a concrete case, may therefore be in order.

One view of the rôle of political boundaries is ably defended by Colonel Sir Thomas H. Holdich.¹ Col. Holdich frankly affirms that the best way to preserve peace amongst the nations is to part them by as strong and as definite a physical fence as can be found. The political boundary must be a formidable barrier. It may be either natural or artificial, but in either case it should be as continuous and as unbroken as circumstances permit. Prevention of war is better than cure, and one of the best preventives is an international boundary which limits the capacity of angry disputants to get at each other. The skill of man can enormously increase the value of such a boundary by constructing an intricate tracery of trenches and fieldworks to link one natural obstacle with another. In this author's opinion the European boundary of the future may well become an actual

¹ Political Boundaries, *Scottish Geogr. Mag.*, Vol. 32, 1916, pp. 497-507.

military barrier bristling with obstructions and points of steel, a barrier so formidable as to approach the ideal of absolute security.

On the basis of this conception of political boundaries, Colonel Holdich proceeds to discuss the relative merits of different natural features as boundary lines. In his view mountain ranges are incomparably the best, since they often constitute impassable border lands, presenting on either hand "a magnificent wall of defense, unbroken, impressive, defiant." It is recognized that in the past armies have been conducted through mountain passes, but the author thinks this phase of history is not likely to repeat itself. The most magnificent natural boundary in the world is considered to be the Himalayan ranges, parting India from the uplands of central Asia and securely defending it from northern invasion. Lesser ranges have a high defensive value, as witness the rôle of the Carpathians in checking the Russian advance on Hungary. Even a comparatively low divide may give sufficient command in altitude to be of decisive military importance.

Rivers are ranked next in value to mountain chains as natural boundaries. They are easily visible and often constitute formidable military barriers. Lakes may be serviceable in boundary-making; and while the position of the actual boundary line may be ill-defined in the broad expanse of waters, the exact position, as in the case of a desert boundary, is of small consequence. Expanses of lake waters and expanses of dry desert are barriers, which, although capable of being crossed, nevertheless commonly separate the peoples of the more habitable regions on either side. Marshes are admitted to have played an important rôle as military barriers in the strategy of the present war, but are rejected as boundary lines for reasons not wholly convincing. Imaginary straight-line boundaries—whether parallels of latitude, meridians of longitude, or azimuth lines—having no natural value as barriers, are classed as "almost invariably bad," and considerations other than military are urged against them.

One may take Colonel Holdich's view of the rôle of political boundaries and still not follow him in all his conclusions. It is interesting to note, for example, that military authorities are by no means agreed as to the defensive value of mountain barriers. Mountainous topography presents obstacles to defensive warfare as well as to operations of an offensive character. Attacking forces have the advantage of being able to concentrate for a crushing blow at any selected point on the line of defense. The defenders cannot concentrate until the blow is about to fall, but must then do so with great rapidity if they are to prevent the breaking of their line by superior forces. Such rapid concentration is always difficult, and sometimes quite impossible, in a region of rugged topography and few good roads. The Archduke Charles was of the opinion that in mountain warfare the advantage was beyond comparison on the side of the attacking army, an opinion further supported by Colonel J. R. Jackson in his little manual

of military geography.² Only in case the war be a *national* war, with the defenders supported by the whole population of the mountainous country, does the task of the invader become insuperable, in Jackson's opinion. Other military writers consider mountains favorable for a tactical but not for a strategical defense.

It is interesting to note that Colonel Holdich's faith in the value of great fortresses as adjuncts to a political boundary has not been shattered by the fate of Liège, Namur, Maubeuge, Antwerp, and the fortified cities of the eastern theater of war. The grounds for his faith do not appear wholly valid, for he credits the original German plan of an attack through Belgium to German respect for the great fortresses from Verdun to Belfort. There is good reason to believe, however, that the unfavorable character of the topography of northeastern France figured more prominently in the decision of the German general staff. Certainly the Colonel is in error in citing Verdun in support of his theory, for the real defense of this historic site was not made from the famous permanent fortifications but from temporary fieldworks so skillfully located as to take every advantage of the natural defensive barriers afforded by a dissected cuesta trenched by an incised meandering valley and its tributaries.

A point of view quite the opposite of that championed by Colonel Holdich is presented by Professor L. W. Lyde.³ In Professor Lyde's opinion the ideal political boundary is not an impassable barrier limiting the capacity of angry disputants to get at one another but "a feature which actually encourages peaceful international intercourse." Since rivers draw the inhabitants of their basins together and offer a maximum of peaceful associations, they are pre-eminently to be desired as boundary lines. Some concession to the military viewpoint appears in the admission that while rivers offer no check to peaceful intercourse, but rather encourage it, they are the more valuable as boundaries because they do serve as checks to unpeaceful intercourse. Emphasis is laid upon the defensive value of river barriers in the Balkan and Eastern campaigns of the present war, a point already discussed at some length by the present writer in earlier numbers of the *Review*.⁴ Other advantages of river boundaries are touched upon, as, for example, the obvious ease of observing the exact position of such a line of demarcation, and the rather questionable supposition that rivers by a rough bisection of their basins make a fairly even division of the enclosing regions and their included mineral wealth.

It must be said that Professor Lyde does not adequately present the objectionable features of rivers, which have given rise to much difficulty with river boundaries in the past. No one can study the varied terms in which river boundaries between our own states are defined without realizing

² *Military Geography: Its Nature, Object, and Importance*, 62 pp., London, 1850.

³ *River Frontiers in Europe*, *Scottish Geogr. Mag.*, Vol. 32, 1916, pp. 545-555.

⁴ *The Great Russian Retreat*, *Geogr. Rev.*, Vol. 1, 1916, pp. 85-109; *The Balkan Campaign*, *ibid.*, Vol. 2, 1916, pp. 27-47.

that the exact delimitation of such a boundary is far from simple. If a shifting river course can cause endless litigation between two states of the same Union, what trouble may it not cause between different nations? Those most familiar with the Rio Grande as an international boundary will hardly confirm Professor Lyde's good opinion of it. More than once its eccentricities have brought Mexico and the United States to the verge of armed conflict, and a special commission has had to undertake the solution of the endless problems it presents. Rivers do tend in some measure to unify the peoples occupying their basins; but will the unit population not often object to being under the control of two different governments? In new lands, such as Africa, proposed river boundaries have had to be changed to divide boundaries, because the single native tribe occupying a given river basin could not well be separated into two independent groups under different civil and military jurisdiction. The counts in the indictment against rivers could be extended indefinitely, and they must be answered before a satisfactory agreement can be reached as to what constitutes the ideal natural boundary.

The latter part of Professor Lyde's discussion has little to do with river frontiers, as it deals with certain broad changes in territory economically and strategically desirable from the standpoint of England and her allies.

As a good illustration of specific boundary problems in which strategic and linguistic considerations appear to be in irreconcilable conflict, we may select the Trentino frontier. The strategic character of this part of the Austro-Italian boundary has been described by the writer.⁵ As was there pointed out, Austria enjoys every strategic advantage in the region in question. The boundary line follows lower crests south of the main divide and is, therefore, dominated by higher points in Austrian territory. It also runs transverse to the main valleys of the southern Alps, which open southward into Italy and facilitate an Austrian descent upon the plain of the Po. This position of the boundary, furthermore, leaves a large Italian-speaking population within Austrian territory.

Whatever the outcome of the present war, some rectification of the present frontier to the advantage of Italy may confidently be expected. Such rectification was, indeed, the subject of negotiations between Austria and Italy prior to the latter country's entry into the war in 1915. Austria at that time proposed to cede to Italy a portion of the Trentino, or "Süd-Tirol," as it is illogically called by the Germans. The territory which Austria was willing to abandon to prevent Italy from joining the Allies coincided roughly with the extension of the Italian language north of the Italian frontier. Italian demands presented then were based, however, upon strategic necessities as well as upon linguistic considerations.

⁵ *Geographic Notes on the War: The Austro-Italian Frontier*, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 526-529.

They therefore outlined a frontier farther north, nearer to the Adriatic watershed.

An interesting discussion of this whole problem is presented by Douglas W. Freshfield.⁶ As set forth by Mr. Freshfield, the Italian claim may be summarized as follows: Starting from Switzerland the present boundary line shall be maintained to Mount Cevedale, whence the new line strikes east to the Illmenspitze and thence northeast to Klausen (its name betrays its strategic importance), passing through Gargazon. From Klausen the line leads to the south until latitude $46^{\circ} 30'$ is attained, after which it resumes its easterly course, passing through Tofana and reaching the old boundary four miles northeast of Cortina d'Ampezzo. The population of the last-named district, formerly Ladin, is now Italian. This boundary revision would give political validity to the Italian Alps, a region which Mr. Freshfield, on the basis of his own observations and supported by quotations from Ratzel, shows to be geographically Italian. It would, furthermore, transfer to Italy strategic control of the entrance to the Vintschgau, of the valley of the Upper Adige, and of "the gorge of the Eisack at Klausen with the issue of the Brenner and Pustherthal railways." The new frontier has the additional merit of being identical with the old Bishopric boundary from 1106 A. D. to the Reformation. The flaw in the proposed rectification, if any exists, is due to the fact that the Bozen district is Teutonic in speech and feeling, although economically it is Italian. The rest of the population in the Trentino favors annexation to Italy.

A contribution to the same problem from the Teutonic point of view is made by R. von Pfaundler.⁷ Von Pfaundler's paper is essentially a discussion of the Austrian offer to Italy in 1915. The line proposed diverges from the Italian project at Illmenspitze, and strikes south in such manner as to avoid cession to Italy of any territory of German speech. In doing this, however, it leaves some of the Italian-speaking northeastern districts of the Noce valley in Austrian territory. All the mountain outlets which converge into the Adige valley are also retained by Austria. From the Italian standpoint this is inadmissible, as it would leave the southern country unduly exposed to unwarranted aggression from the north.

On the basis of the Austrian census for 1910, von Pfaundler thus tabulates the changes in population consequent upon such a boundary revision as Austria proposed:

	<i>Italians and Ladinians</i>	<i>Germans</i>
In territory offered by Austria.....	366,837	13,892
In territory retained by Austria.....	18,863	511,222

Relying upon the same source of information, he shows that Italy's official claim implies the inclusion in Italian territory of 74,000 Germans

⁶ The Southern Frontiers of Austria, *Geogr. Journ.*, Vol. 46, 1915, pp. 414-433.

⁷ Oesterreichisch-Italienische Grenzfragen, *Petermanns Mit.*, Vol. 61, 1915, pp. 217-223.

along with the 371,477 Italians and Ladinians who would thereby be incorporated in the southern kingdom.

To the impartial observer it would seem that the Italian claim offers the more equitable division of those strategical advantages which each nation considers essential to national security. It would leave to Austria the watershed, a position admirably suited for defense; and would at the same time award to Italy control of the outlet passes. Each country would thus find itself secure from sudden aggression on the part of the other. The Austrian offer, on the contrary, altogether disregards Italy's strategical necessities.

The four papers reviewed above are typical of many discussions now occupying the attention of geographers and serve to illustrate the nature of the problems which very shortly will command the interested attention of the whole world. Whether from the standpoint of the general principles involved or from that of the practical application of those principles to concrete cases, the early selection of new boundaries for certain European countries will demand, and should receive, the best knowledge and highest skill of both geographer and statesman.

THE PASSING OF THE FAHRENHEIT SCALE

By ALEXANDER McADIE

Director of the Blue Hill Observatory

Geographers may have noticed that in recent climatological work, and in all exploration of the atmosphere, temperatures are not given in Fahrenheit degrees but in degrees Absolute Centigrade. They will notice, too, that the familiar degree sign ($^{\circ}$) is now omitted and reserved for degrees of angular measurement. Geographers have a right to ask why such changes are necessary.

The prime reason is that in exploring the upper air and in all work relating to the structure of the atmosphere, or *aërography*, the majority of the readings are below the zero of both the Centigrade and the Fahrenheit scales. This results in a multiplicity of minus signs. At a height of four kilometers and above, temperatures are below the zero of the Centigrade scale, even in mid-summer and even over the equator; and at a height of six kilometers the same is true for the Fahrenheit scale.

A second reason is that half the world, the larger half, uses the Centigrade scale; and the rest, except a small portion to be mentioned later, uses the Fahrenheit. In Germany and some other parts of Europe, a third scale is used, chiefly for domestic purposes, known as the Réaumur, with the ice point marked 0° and the steam point 80° ; but this scale is so little used by scientific men that in the International Tables, no conversion tables are given. It is not necessary to give in detail the steps in the development of the thermometer from the crude instrument of Galileo and the form used by Sanctorius to modern standards, nor may we here discuss the evolution of thermometer scales. The Fahrenheit scale ran originally from 0° to 8° , the former being the lowest temperature then obtainable by artificial means and the latter being the temperature of the human body. Subsequently each degree was divided into 12 parts. Later the freezing point was marked 32° and the boiling point placed 180° higher and marked 212° . The zero of the present Fahrenheit scale is 459.4° above the so-called absolute zero or, to express it in other terms, the absolute zero or zero of no molecular motion is 491.4° F. below the freezing point of water.

There have been various temperature scales, one being that of Sir Isaac Newton, where the ice point was 0° and the temperature of the human body 12° . The original centigrade scale had the boiling point marked 0° and the freezing point 100° and was known as the Celsius. Linnæus reversed the order.

Now it will be conceded that if we are to use a zero or starting point it is advisable to use the ultimate rather than some intermediate value. There

is such an ultimate value in temperature, determinable in two ways, one known as the absolute thermodynamic method and the other as the hydrogen gas thermometer method. The latter, which is the adopted method, gives a coefficient of expansion such that we can express the zero as -273.02°C. ; or the freezing point on the Centigrade scale is 273 degrees higher than this zero. If, then, we start with this zero there will be no need for minus signs; and largely for this reason physicists, chemists, and others have begun to use generally the Absolute Centigrade scale.

Many meteorologists hold that the Fahrenheit scale has one great advantage over both Centigrade and Absolute, in that, the scale division being smaller (nine divisions on the Fahrenheit corresponding to five on the Centigrade scale), it is possible to give readings with more definiteness. Some climatologists think that the Centigrade scale division is too large for their purposes; but as a matter of fact the errors of exposure are so much larger than errors of reading that the refinement seems unnecessary. Nevertheless, to meet the objections of meteorologists, climatologists, and others, the writer has proposed a new scale, a new absolute, which for want of a better name may be called the New. The starting point is the same as in the Absolute and is written 0. The freezing point is marked 1,000. The diagram herewith (Fig. 1) shows the readings on the four scales in close proximity so that the general relations can be readily grasped.

The scale divisions on the New scale are even smaller than the Fahrenheit and meet the problem of refinement of reading. Again, as in the Absolute scale, there are no minus signs. In the third place, there is a saving of figures in tabulating, printing, and even speaking, although at first

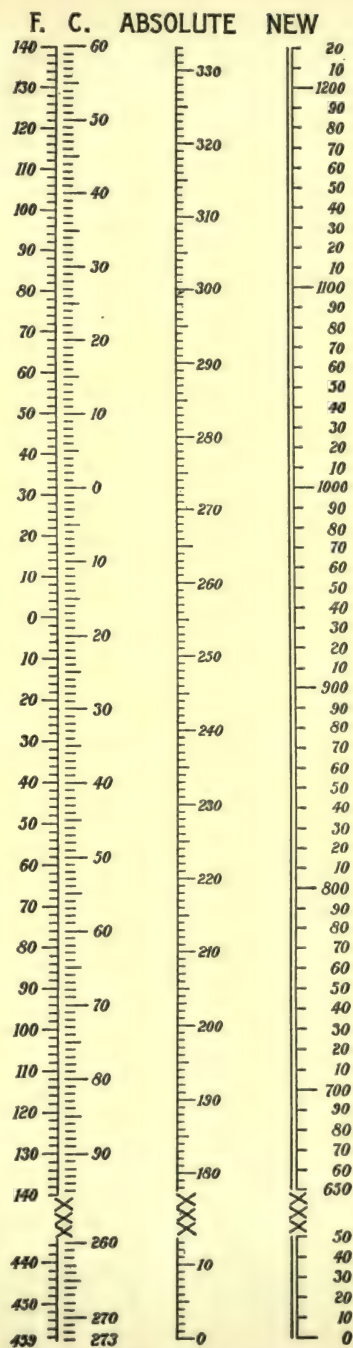


FIG. 1.—Comparison of four thermometer scales, Fahrenheit, Centigrade, Absolute, and New.

glance this might not seem to be the case. Fourth, the New scale makes for accuracy in compilation, as an erroneous entry is more easily caught by the eye, and in the determination of mean values the larger units are of the same order.

Fifth, there is a fundamental distinction between *warm* and *cold*, which is shown by the range of one hundred divisions, all readings below 1,000 being *cold*, and all readings above 1,100 being *warm* (on the Fahrenheit scale these would be 32° (freezing) and 80° (summer heat)).

Sixth, winter temperatures are more readily and definitely given, as e. g. -10.8° F., a not infrequent reading in many parts of our country in winter, becomes 915. In tabular work, only three pieces of type would be needed in place of eight.

Seventh, when it is very hot or very cold, the public wants the fullest details. Fine distinctions or graduations appeal to the imagination at such times, especially if conditions approximate a record. Given an extremely warm day, it could be described on the New scale as "eleven forty," 1,140; and an extremely cold day as "nine ten," 910. The equivalents are 100.6° F. and -12.1° F. and 38.3° C. and -24.6° C. respectively.

Finally, there is an educational aspect which is perhaps of more importance than all the preceding arguments. To the teacher, it is always difficult to explain, so that a class clearly grasps the relation, the law of Charles or yet again the characteristic equation of a pure gas. The fraction $1/273$ is an awkward figure to remember and the student mind resents such a coefficient of expansion, which seems to him irregular and unnatural. When relations are not clearly comprehended, they are readily forgotten. The new scale makes for clearer conceptions of the nature and magnitude of temperature changes. It starts from a definite value, one that has a distinct physical meaning, and also makes use of that most familiar change of physical form, water to ice. If we could only introduce at the freezing point and at the boiling point some auxiliary extension tables giving the degrees of heat of fusion and evaporation, the so-called latent heats, then the whole conception of heat, the whole process of molecular change, the work-equivalent of heat and the heat-equivalent of work would take on a new aspect for the student.

GEOGRAPHICAL RECORD

NORTH AMERICA

The Navajo Country. The Navajo, Apache, and Hopi Indian reservations of Arizona and New Mexico and the areas immediately about them form a geographic province of singular interest in regional geography, and one practically unknown until the publication by H. E. Gregory of an article entitled "The Navajo Country" in the former *Bulletin* of this Society (Vol. 47, 1915, pp. 561-577 and 652-672). Prof. Gregory has extended his writings since that time and under the same title has now produced a government report on the water supply of the region, including notes on the geology, topography, climate, vegetation, and early exploration. The field surveys covered the period 1908-1913; and the published report represents an extensive and important reconnaissance survey. It will long be practically the sole source of geographic information on a remarkably interesting portion of our domain where man's adaptation to a rugged and deserts land is of the most extreme kind.

The photographs deserve special mention in that they represent to an unusual degree the characteristic as well as the striking geographic and geologic aspects of the country. A large map (Pl. 1) shows the routes of earlier scientific expeditions, the locations of buildings, the relief (by hachures), the drainage, and the boundaries of the geographic provinces. The forest map (Pl. 19) by G. A. Gutchess is a real contribution and brings out in a striking manner the effects of relief upon rainfall and vegetation. It is with respect to these features that the plastic character of the Indian population is so well expressed. The report supplies a broad physical basis for further research, though its usefulness would have been enhanced by a general summary of conclusions.

There should soon be undertaken a thoroughly scientific anthropogeographic investigation of the desert western country (if possible in connection with the next census) to the end that we may ultimately have a population map showing the *real* distribution of the people. Jefferson's studies, and particularly his paper entitled "Utah, the Oasis at the Foot of the Wasatch" (*Geogr. Rev.*, Vol. 1, 1916, pp. 346-358) emphasize the striking distribution of the belts of desert population as brought out on maps whose boundaries follow natural division lines and not the borders of minor political divisions that have no diagnostic value.

Avalanche Wind Near Juneau, Alaska. Winds resulting from avalanches or landslides are an interesting group in any complete classification of the winds of the world, but are of relatively rare occurrence. On Jan. 26, 1917, as a result of a heavy snowslide into Gold Creek Gulch, an avalanche wind occurred near Juneau, Alaska. The force of the blast generated by the down-rushing snow was sufficient to demolish some cabins and to carry their debris up the opposite slope, together with some 4 x 4-inch timbers and 12 x 2-inch cross planks of a board walk. A large piece of concrete chimney was also carried up the slope. The wind had a lateral as well as forward component, for it destroyed a cabin 500 feet down the gulch in the direction of Juneau, the edge of the city being only about a quarter of a mile away. The wind was felt throughout the city. A blinding whirl of snow came with the wind, and enveloped the city in semi-darkness for several minutes.

R. DEC. WARD.

A New Map of the Physiographic Divisions of the United States. The Association of American Geographers, organized in 1904, has been one of the most important instruments in America for the encouragement of geographic research. Among its achievements since its foundation there is certainly none other so important as the physiographic map of the United States produced by a special committee of which Prof. N. M. Fenneman was chairman (*Physiographic Divisions of the United States, Annals of the Assoc. of Amer. Geographers*, Vol. 6, 1916, pp. 19-98; map, Pl. 1, scale 1:7,000,000). We recognize in this work two qualities—the one scientific, the other diplomatic. Professor Fenneman devoted the best part of a year to the task of compiling the essential facts and arranging them in systematic order. It was then necessary to secure discussion on the part of the members of the committee and concurrence on questions of boundary delimitations. When we consider the vast extent of the territory involved and the salient personalities of the men who were bound to be associated on such a committee, it increases our admiration for the happy results which have been achieved under Professor Fenneman's leadership. Every other member of the committee, and especially M. R. Campbell of the U. S. Geological Survey, likewise deserves the thanks and congratulations of the Association of American Geographers.

The detailed characterization of the article and the map is outside the purpose of this notice. We need indicate only a few leading features. The United States is divided into primary divisions, as represented in a general way on maps heretofore known to physiographers; but each division is further divided into provinces and sections. Of the former there are 24 and of the latter 88, counting undivided provinces. The characteristics of each minor section, expressed in terse technical language, are particularly helpful. The assistance given by such a characterization in further research is beyond praise. It matters little that the boundaries of the provinces will be subject to minor changes in later years or that the technical descriptions may require modification as each minor section becomes better known through detailed surveys. The point of chief importance is that we now have an authoritative beginning for the interpretation of the human life of the United States. Hereafter the regional geography of the country will be written on an entirely new basis.

No better service could now be rendered than that of interpreting the distribution of population in terms of physiographic regions. Here lies the great importance to geographical science of the next census. It would be an almost inconceivable neglect of opportunity to have the population maps drawn without reference to the boundaries of the physiographic provinces. Detailed physiographic field work is essential to supplement the statistical facts and this ought to be done in co-operation with some physiographic committee which would actually and precisely delimit the details of each boundary in the field. The county unit is too gross for this purpose and even the township unit ought to be split in critical cases. This would afford geographers an opportunity for the first time to make a really scientific study of the distribution of population. It is not meant to imply that physiographic features are a primary control of distribution. But relief, and all that goes with it, is in many cases the primary control; and the extent to which this control is exercised can never be demonstrated—physiographic influence can never be isolated from other influences—until a study is undertaken on this plan. The Census Bureau will surely not fail to seize this great opportunity.

Corn-Growing under Droughty Conditions in the United States. The detailed study of climatic data in connection with agriculture is one of the increasingly important developments of modern climatological research. It is a significant fact that many of the recent publications emanating from the Bureau of Plant Industry, the Office of Farm Management, and the Weather Bureau are concerned with these economic aspects of climatology. Clearly, *economic climatology* is now of sufficient importance to warrant the use of this term. Messrs. C. P. Hartley and L. L. Zook, of the Bureau of Plant Industry, have been investigating corn-growing in the drier portions of the United States (*Farmers' Bull.* 773, U. S. Dept. of Agric., Washington, 1916). Farmers from the East have for fifty years been attempting to raise corn in the semi-arid West. The seed and the methods used were almost always those of the East, not adapted to western climatic conditions and hence often resulting in failure. It is the purpose of this bulletin to indicate the causes of these failures and to show how failures may become less frequent and less serious. An improvement of the yield of corn per acre and a less wasteful utilization of the crop are important. The average acre yield is now less than one-half what it might easily be, and while it is increasing in the older states, it has remained about 27 bushels for the country as a whole. This fact has been largely due to the expansion of corn-growing into semi-arid and otherwise unsuitable regions. The cultivation of corn under droughty conditions "is largely a matter of taking chances with seasonal conditions." On the other hand, there are certain controllable conditions of soil and seed which frequently determine the success or failure of the crop. It is with these latter factors that this bulletin is concerned.

R. DEC. WARD.

New York as a World Market for Cacao. In 1915 New York became the coffee capital of the world and the clearing house for Europe. That a similar position will be occupied in respect of cacao appears probable (*Commerce Repts.*, 1917, No. 66). During the fiscal year ending June 30, 1916, advance in this direction continued; the re-exports of cacao were about \$31,500,000 against \$29,000,000 in 1915 and \$4,500,000 in 1914. As the leading buyer of the crude product New York made great gains also, the increase in quantity and value being respectively 26 per cent and 53 per cent over 1915, itself a record year. Contributory to these movements are changes in the ports of shipment. Several cacao-producing countries are now shipping direct to the United States for the first time. Such are British Guiana, Peru, the Dutch West Indies, French Africa, and, most important, British West Africa, from which last place the output has greatly increased in quantity and improved in quality. Importation from British West Africa was only exceeded by that from the Dominican Republic, Brazil (which showed a gain of 300 per cent over the previous year), and Ecuador.

SOUTH AMERICA

A New Port on the West Coast of Peru. The desert coast of Peru has over thirty main valleys, each of which has an irrigated alluvial floor, a port at the valley mouth or in some sheltered curve of the coast near by, and barren desert country between it and the neighboring valleys on either hand. The desert coastal strip is narrow and, save for Lima and Arequipa, there are no really large towns. Each valley is notably independent. Trade and even travel are by way of the sea rather than overland. The effect has been to call into existence a large number of small "ports." In the main these are distinctly primitive. Callao is the only one in which ships can discharge their cargoes directly upon the docks. All others are reached by lighters which in turn discharge at steel piers built out beyond the reach of the surf as at Eten or in some sheltering cove as at Mollendo. The expense of huge modern port works could not be borne by any one of the valleys and since railways run down to the coast, and not along it, no valley can attract the trade of a number of adjacent valleys. It follows that small steamers, easy to build and with moderate operating losses due to port delays, serve the commercial interests better than large vessels of the trans-atlantic type.

On the map, Fig. 1, it will be seen that Salaverry is one of the chief ports of Peru. It is the outlet for one of the richest valleys of the coast. But it is exposed to the strong surf; and therefore the sugar interests of Ascope, an interior town, have arranged for the construction of a new port at Malabrigo, which is sheltered by Malabrigo Point against the prevailing southwest winds. A railroad will connect the Ascope plantations with the new port and serve not only the sugar trade but mining interests as well, thereby competing seriously with the dock and railway at Salaverry and making one more port of call for the already over-crowded schedules of the west-coast steamers (*Commerce Repts.*, March 30, 1917, No. 74). According to Vallejo's Mapa del Perú published in 1912 by the Sociedad Geográfica de Lima (scale 1:1,500,000) the distances in straight lines from Ascope to Malabrigo and from Ascope to Salaverry are 22 miles and 37 miles respectively.

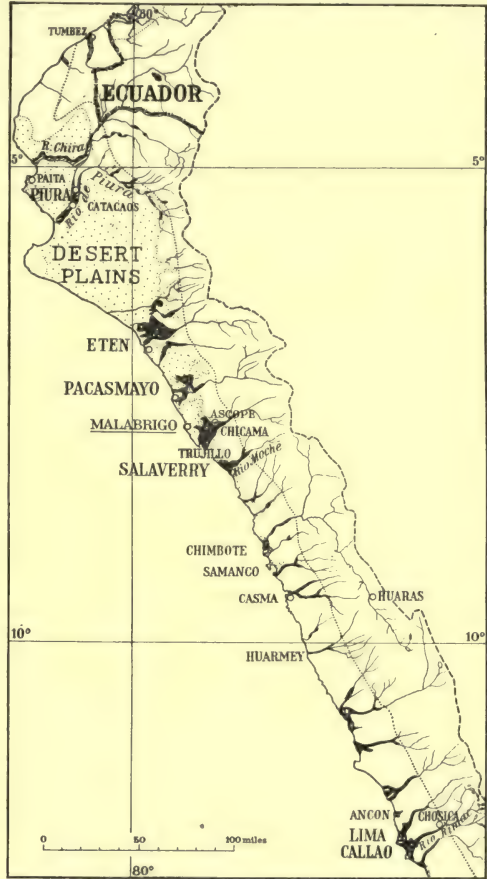


FIG. 1—The position of the port of Malabrigo (underlined) in relation to the neighboring ports of Peru.

The Effects of the War on the Chilean Nitrate Region. One of the first effects of the war was greatly to depress the nitrate industry—practically the sole basis of the commercial life of the pampa region in northern Chile. Banks failed or suspended payment; longshoremen out of work threatened disorder; and many of the nitrate *oficinas* were obliged to close. Hundreds of laborers came down from the pampa to the coast towns where, in large numbers, they slept on the docks while waiting for the next steamer. The government offered free passage to all Chileans who wished to return to the farms of the south and to all Peruvians and Bolivians who cared to return to their respective countries. No such exodus had ever before been seen in the nitrate country (*Conditions in Chilean Nitrate District, Commerce Repts.*, Sept. 25, 1914, No. 225). The total number of unemployed in the nitrate plants and coast ports reached 33,000, half of whom were

heads of families, according to the report of the commission appointed to take care of the unemployed arriving at Iquique (*Commerce Repts.*, Dec. 9, 1914, No. 288). The significance of these figures arises from the fact that by far the larger part of the population in the whole country is dependent upon the 100,000 people directly engaged in nitrate production or trade. Furthermore, 58 per cent of the total customs revenues of the whole country are derived from the import and export duties of the nitrate region. In some years the export duties on nitrate have been not less than 85 per cent of the total national income (W. S. Tower: *The Nitrate Fields of Chile*, *Pop. Sci. Mo.*, Vol. 83, 1913, pp. 209-230. This is the best geographic article on the nitrate country yet published.) The export duties on nitrate and iodine normally produce \$28,000,000 American gold. The government has for years maintained its employes and carried out improvements in other parts of Chile largely from revenues obtained from the nitrate region. As shown in Fig. 1, the production of nitrate steadily increased until the war broke out.

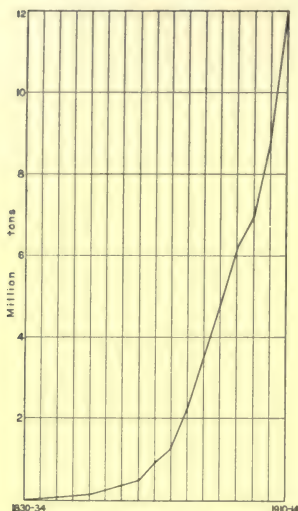


FIG. 1.—The production of nitrate in Chile by five-year periods. Figures for 1830-1839 are from Paz Soldan: *Geografía del Perú*; for 1840-1894 from Ortizar: *Chile of To-day*; for 1895-1914 from F. López Loayza: *La Provincia de Tarapacá* and from current numbers of *The South American Journal*.

The depression in the mining business has now been measurably overcome, owing to unprecedented prices for nitrates and copper and the huge sales of these products in 1916. The paper *peso* has advanced in value from 17½ cents to 22½ cents and the chronic annual deficit was changed in 1916 to an actual surplus (Prosperity in Chile, *Commerce Repts.*, March 20, 1917, No. 65).

Since Germany formerly took about 30 per cent of the nitrate exported, and since that country has probably developed economic methods for the extraction of nitrate from the air which will probably make her independent of Chilean nitrate, much attention has been given of late to the development of more economical business methods and to the extraction of a higher percentage of nitrate from the raw *caliche* (*Commerce Repts.*, Nov. 10, 1916, No. 10).

A New Determination of the Area of Peru. A new calculation of the area of Peru places the superficial extent of the country at approximately 534,000 square miles. This figure, obtained by measurement from Raimondi's map on the scale of 1:500,000, is a reduction of 20 per cent on that of 1876 carried out in a similar way (*Bol. Soc. Geog. de Lima*, Vol. 31, 1915, pp. 45-50). The principal loss of territory has been sustained in Loreto, the vast department of the eastern plains where Peru meets the republics of Colombia, Ecuador, Bolivia, and Brazil. Between Peru and the two latter countries boundary disputes were settled in the agreement of 1909 and since that time delimitation of the frontiers had been actively prosecuted. The work of the Peru-Bolivia Commission has been recently described by Colonel Holdich (*Geogr. Journ.*, Vol. 47, 1916). Boundaries between Peru and Colombia and Ecuador are still in dispute. Since 1879 Peru has also lost the nitrate province of Tarapacá. The above calculation, however, includes Tacna department with an area of 12,500 square miles.

AFRICA

Mineral Wealth of Katanga, Africa. Professor René d'Andrimont, in charge of geology at the Agricultural Institute of Belgium, has written a paper "*Le Katanga et ses richesses minérales*" (*La Nature*, No. 2255, 1916, Dec. 16, pp. 385-391), in which he concisely discusses not only the important metals, diamonds and coal of the southeastern part of the Belgian Congo but also their limited occurrence northward to the west of Lake Tanganyika. He says the metals are found especially in faulted areas, where the movement of metalliferous magmas to or towards the surface was facilitated. Copper, tin, gold, and diamonds were discovered in these zones of fracture. The most important gold deposits, however, have been found at Kilo, to the northwest of the great fracture-bordered graben filled by Lake Tanganyika, where gold to the amount of \$2,000,000 has been mined in the past few years. No gold in paying quantities has yet been found in Katanga though there are many traces of it. Further search may be amply repaid, as in the case of the adjoining colony of Rhodesia.

The Ubamba depression, to the northwest of Elizabethville, is estimated by British and Belgian experts to contain tin worth \$12,000,000. In a depressed area adjoining (Kundelungu), the English have found "pipes" containing diamonds as in the diamond mines of the Union of South Africa. Investigation is not yet so far advanced as to show whether diamond mining will be profitable. Copper is still the great mining industry of Katanga. The carbonate copper beds in the south are among the richest in the world, the mineral yielding from 12 to 14 per cent of metal. An adequate explanation of the very irregular distribution of these ores will not be found till the beds are known to their depths. Their upper part is in the form of sediments impregnated by carbonates.

Coal is the most recent discovery in Katanga. Two areas of coal have thus far been found. One of them is only six miles from the west coast of Lake Tanganyika on the line of the railroad connecting the lake with the Congo River and completed shortly before the war began. The four beds found there cover an area of some thirty square miles. This coal is now used on the Tanganyika steamers. The other coal find is in the region of Bukama which stands on the last navigable stretch of the upper Congo and is now being connected with Elizabethville by rail. This road will link the Congo with the great copper field that extends between Elizabethville and Kambove. CYRUS C. ADAMS.

Winds Over Northern Africa. In his presidential address before the Royal Meteorological Society, Major H. G. Lyons, F.R.S., considered the distribution of pressure and the air circulation over Northern Africa (*Quart. Journ. Roy. Met. Soc.*, Vol. 43, 1917, pp. 116-150). All of North Africa is arid. Some rain falls on the Mediterranean coast in winter, but south of the line Timbuktu-Lake Chad-El Obeid a fair amount of rain falls in July to September. The climatic characteristics of the region as a whole are high temperatures, large temperature ranges, low relative humidity, an almost cloudless summer, a moderate cloudiness in winter, and generally moderate wind velocities. These conditions extend in winter to 10° N., and in some places, as in the Egyptian Sudan, to 5° N. Major Lyons is of the opinion that the northerly and northeasterly winds of the French Sahara, and the northerly winds of the Nile Valley, may properly be called "trade winds" because they are maintained throughout the year as a steady circulation. They are not, however, to be regarded as convective currents forming part of a circulation between hotter and cooler regions, determined by such a difference of temperature. They are rather "geostrophic" winds, flowing around the Azores "center of action," whose influence extends to northeastern Africa in winter. In summer, the low pressure system of southern Asia maintains the northerly flow of air over Egypt and the surrounding region. R. DEC. WARD.

AUSTRALASIA AND OCEANIA

An Expedition to Easter Island and Its Results. Easter Island has long provided one of the most fascinating puzzles of the Pacific Seas. Towards the solution of its mysteries the Scoresby Routledge Expedition has made an important contribution. The expedition left England in 1913 and was absent three years, of which time about sixteen months were spent on the island. During this time supplies were secured from the Chilean mainland 2,000 miles distant.

From its discovery in 1722 by the Dutch navigator Roggeveen the isolated volcanic isle has been known for its strange megalithic statues (see *The Voyage of Captain Don Felipe Gonzales to Easter Island 1770-1: Preceded by An Extract from the Official Log of Mynheer Jacob Roggeveen in 1722, Hakluyt Soc. Publs.*, 2d Ser., No. 13, 1908). To the exposition of the culture they represent the work of the expedition was devoted. It embraced two fields—archeological and ethnological. The former included description and measurement of the great stone figures and a study of their distribution. The distribution is three-fold. They are related to the wrought stone terraces facing the shores; they are scattered on the volcanic slopes; and they line the quarry wherein all were fabricated. The statues that once stood on the terraces have all been overthrown, apparently in tribal war and within historical time. The statues on the slopes, also prostrate, appear to have bordered the roads leading from the quarry; on the longest road they must have been placed every few hundred yards apart for a distance of six miles. Most interesting are the statues in the quarry. In various stages of completion they number 150. The whole process of carving even to the number of workmen employed on them is clearly seen; and the tools, the harder obsidian scouring in the easily wrought volcanic ash, have been found. It is astonishing to learn that a figure could probably be completed in a fortnight. No hint as to the means of transportation, a much more arduous task than the carving, could be discovered.

From the ethnological point of view the last 50 years have been the most disastrous in the island's history. During the expansion of the Peruvian cotton industry in the early

sixties slave raiders from Peru carried off half of the native population, including the principal men. Today only 250 islanders exist. Since a Chilean company started ranching on the island they have been confined to a reservation. The raiders were immediately followed by Roman Catholic missionaries through whose efforts the old customs and traditions were prematurely curtailed. Knowledge of the stone statues and of the possibly related wooden images has practically disappeared. Detailed acquaintance with the wooden tablets bearing the unsolved hieroglyphic writing is fast vanishing, too. The old people, however, could remember the time in their youth when the writing was still a living part of their civilization but it was taboo to all the uninitiated and there now survives only one old man who had begun to learn the sacred art. One tradition remains in clear memory—the peculiar “bird-cult” that centred around the annual discovery of the first egg of the birds coming to nest on the island each spring.

From the surviving material the expedition appears to have secured practically all the data that the island can itself reveal. Further elucidation must be sought afield. In particular it is necessary to know more of the migrations in the Southern Seas whence rather than from the east the civilization of Easter Island seems to have come. Mrs. Scoresby Routledge's report of the expedition read before the Royal Geographical Society aroused much interesting discussion and in its published form (*Geogr. Journ.*, May, 1917) has prompted the appearance of other communications on the subject. Such is Notes on Easter Island by B. Glanvill Corney (*Geogr. Journ.*, July, 1917), in which is reviewed the account of Easter Island compiled by Paymaster Richards of the Challenger Expedition and contained in his manuscript diary.

Wind Direction Indicated by a Volcanic Cone. In their asymmetrical contour the volcanic cones of Hawaii preserve a meteorological record in durable form. The typical elongation of the cones in a northeast to southwest direction bears witness to the steady prevalence of the northeast trade wind. Material in the process of ejection is naturally deflected to the leeward of the growing cone and its symmetry thereby destroyed. An exception to this general phenomenon is to be found in the Punchbowl, an old crater hill lying in the heart of Honolulu. The configuration of the Punchbowl indicates that during its formation the dominant wind blew from the southeast. Such a wind, named the “Kona,” blows erratically at infrequent intervals mainly during the rainy season. It is believed that the Punchbowl was built up in a single rapid explosion probably lasting a few hours only. (Vaughan MacCaughy: The Punchbowl: Honolulu's Metropolitan Volcano, *Sci. Monthly*, June, 1916, pp. 607-613.)

The 1916 Census of Population in New Zealand. Some preliminary results of the 1916 population census of New Zealand are published in the Official Year-Book of that date. The population, exclusive of the Maoris and the residents of the Pacific islands annexed in 1901, is 1,099,044, representing a population density of between 10 and 11 to the square mile. To this the major divisions contribute unequally. North Island has 14.5 to the square mile, South Island 7.5. While the area of occupied pastoral land is far greater in South Island than in North Island the land under cultivation in the latter is nearly twice as great as in the former. In comparison with figures of the two preceding quinquennial periods the increase from 1911 to 1916 shows a marked drop, being about 9 per cent as compared with increases of 15 per cent from 1901 to 1906 and 13.5 from 1906 to 1911. The decline is accounted for by the curtailment of emigration since the beginning of the war and the withdrawal of troops for over-seas service. In 1913 the net gain of arrivals over departures amounted to more than 14,000; in 1915 it was reduced to 3,000.

PHYSICAL GEOGRAPHY

Frequency Curves of Climatic Phenomena. Successful agricultural practice requires a knowledge of the frequency of occurrence of unfavorable weather phenomena. Mean values, even single absolute extreme values, are obviously not satisfactory. H. R. Tolley, of the Office of Farm Management in Washington, has recently been giving special attention to this subject, and has brought out some results which are of immediate and practical use (*Frequency Curves of Climatic Phenomena, Monthly Weather Rev.*, Vol. 44, Nov., 1916, pp. 634-642). Normal frequency curves have been plotted for the date of last killing frost in spring (33 stations, 823 observations) and for annual rainfall (21 stations, 963 observations). The development of such diagrams, and the determination of the normal frequency curves, involves much labor and a certain mathematical ability, but there is no question about the practical importance of the results. A number of other frequency curves, and the numerical and mathematical data used in the computations, are included.

R. DEC. WARD.

Climatic Factors in Plant Life. As agriculture comes to depend more and more upon refined studies of climatic factors, empirical and wasteful experiment is rendered unnecessary. Some of the results of studies now under way are striking in their real practical importance. For example southern Ontario grows tobacco and grapes. Where else in Canada may equivalent climatic conditions be met? Not as might be supposed in merely "milder" regions. Victoria, British Columbia, has a longer period of active growth (268 days against 216 in Toronto), a longer frostless period (233 days against Toronto's 165), a slightly greater total of "heat units" for the year, and a much smaller sum of "cold units." But Victoria has only four days of "tropical heat" to Toronto's 45 and a smaller number of heat units during the growing season. By days of "tropical heat" is meant days with mean temperature over 68° F. Active growth is considered to begin at temperatures of 41° F. or over. The terms "heat units" and "cold units" are used to describe total temperature effects. The heat unit is defined as a temperature of 1° F. above the freezing point continued for the duration of an hour; the cold unit is a similar measure below the freezing point. These and other temperature elements are set forth in a paper by J. Adams (*The Quantitative Study of Climatic Factors in Relation to Plant Life, Trans. Roy. Soc. of Canada, Section 9, Geol. and Biol. Sci., Ser. 3, Vol. 10, 1916, pp. 105-123*). Besides the temperature factor the author also makes analyses of light, precipitation, evaporation and wind in relation to plant life. In particular he emphasizes the value of evaporation, the most significant factor that can be readily measured.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

South Atlantic States

MATSON, G. C., AND SAMUEL SANFORD. **Geology and ground waters of Florida.** 445 pp.; maps, diagrs., ill., index. *U. S. Geol. Survey Water-Supply Paper 319.* Washington, D. C., 1914.

Nearly half of this volume is a sketch of the topography, hydrography, shore lines, and stratigraphy of Florida, being a revision of a similar work by Matson, Clapp, and Sanford published four years earlier in the Second Annual Report of the Florida Geological Survey. The remainder is devoted primarily to hydrology and includes notes on the topography, geology, and underground waters of the several counties, with about four pages on each one. Wherever the treatment of topography and geology differs from that in the Florida geological report it is usually as a result of additional field work by Mr. Matson in the winters of 1909-1911 and by Dr. T. W. Vaughan. Mr. Sanford's work was in the southern half of the peninsula and was all done prior to the earlier publication. The water resources of most of the counties had been described previously, with more topographic details, by Sellards and Gunter in the 3d, 4th and 5th annual reports of the Florida survey, but these reports seem to be ignored in the present publication. Of the 28 half-tone illustrations, nine seem to be from photographs previously used in the Florida second annual report, and two were published in 1912 in *Geological Survey of Georgia Bulletin 26* (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 920-923). The large geological map of the state is very similar to that used in the state report four years earlier, but the small colored map showing supposed Pleistocene terraces is entirely new.

Part I, with 44 pages, entitled "geography," is mostly devoted to topography; and Matson describes northern and central Florida and Sanford southern Florida. Matson divides the state into only three topographic provinces: the upland or lake region, the lowlands, and the coast. The first has a maximum altitude of only about 300 feet, but is very diversified nevertheless; and the contour map of a small area selected to illustrate its topography does not belong to the true peninsular lake region (mapped by the reviewer in the 3d annual report of the state survey, January, 1911) at all, but represents a very typical portion of the lime-sink region. The lake region seems to taper northward into a long narrow ridge parallel to the Atlantic coast, known as Trail Ridge, which is mentioned a few times in this report, but without any attempt to explain it (see *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, p. 922). The effects of erosion are perceptible in the northern, and particularly the northwestern, part of the state, but not conspicuous in the peninsula, where streams are scarce and sluggish, and solution and wind work seem to have been more potent.

The lowland area corresponds approximately with that part below the 100-foot contour and is now regarded by Matson as being divisible into three Pleistocene terraces (which are shown on one of the folded maps). Such terraces were traced in the coastal plain of Maryland some years ago (see Maryland Geological Survey report on Pliocene and Pleistocene, by G. B. Shattuck and others, 1907), but the extension of the terrace hypothesis to Florida is something new. There is scarcely a hint of it in Matson's contribution to the Second Annual Report, published at the beginning of 1910, or in Vaughan's important "Contribution to the Geologic History of the Floridian Plateau," published nearly a year later (*Carnegie Inst. Publ. 133*, 1910, pp. 99-185; abstracted in *Science* for July 1, 1910). The evidence in favor of terraces is not given very fully in the report under consideration, but it is to be hoped that a more complete discussion will be supplied in the near future. Until then perhaps it will be best not to

attempt to judge of its correctness; but it may be observed here that if the existence of such terraces, and their geographical significance, can be satisfactorily demonstrated, it will call for profound modifications in the system of geographical divisions of Florida outlined by the undersigned in the 3d and 6th annual reports.

About four pages in Matson's part of the report are devoted to the diverse features of the coast and the work of waves, tides, shore currents, and corals. A three-page section on soils has little connection with the rest of the work. The growth of pineapples on old dunes near Fort Pierce is cited as "a striking example of the productivity of a sandy soil properly tilled"; but in that case the soil is nearly pure silica and serves merely to anchor the roots, and its apparent productivity is due to the use of commercial fertilizer at the rate of over \$30 per acre per year! (For any other crop than pineapples probably much more fertilizer would be required.) The advantage of using lime on some Florida soils is briefly mentioned, but there is no intimation that the average Florida soil is more deficient in potassium than in any other essential element (and more so than that of any other state; presumably because the peninsula is remote from all igneous rocks and from streams traversing such rocks, and most of its strata are of organic sediments).

Sanford's contribution of 23 pages on southern Florida does not differ much from the corresponding part of the Second Annual Report. Although that part of the state is very low, it is considerably diversified, and among its features are described dunes, rolling sand plains, flat lands, rock ridges, the Everglades, cypress swamps, mangrove swamps, keys, and shore lines. The dunes are mostly on the east coast, and most of them are stationary and well covered with vegetation. One near Hobe Sound rises to 63 feet above sea-level. As a rule the old dunes of the east coast stand a little back from the coastal lagoons and a mile or two from the present ocean beach. Sanford regards them as having been formed when the land stood at least ten feet higher above the sea, and thus as indicating a subsidence of that amount since the Pleistocene. (He has recently reiterated that belief in *Science*, Vol. 43, 1916, March 10, pp. 348-349.) But to the reviewer the facts indicate nothing of the sort, and perhaps just the opposite. For active dunes in humid climates, in the eastern United States at least, seem to occur only within half a mile or so of wave-washed sandy beaches, of lakes or oceans; and the fact that the fixed dunes of Florida average a mile or two from the present coast seems to indicate a seaward movement of the shore line, by elevation or otherwise, since they were formed. (It is difficult to imagine how any sinking of the land could diminish the force of the wind on active dunes and allow them to become overgrown with forests.)

Sanford's description of the Everglades covers five pages, and when first published, early in 1910, it was probably the most complete and accurate there was. The tall mangrove forests of the Ten Thousand Islands, unlike the bushy mangrove swamps of the east coast, are probably known to but few botanists. The fact that the Keys form two groups (separated by Bahia Honda Channel), differing considerably in geology, topography, and vegetation, was probably almost unknown when Sanford first published his description (see *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, p. 521). Those of the upper or northeastern group are formed of recent coral rock, while the lower or western keys are of Pleistocene oolite, much like that on the mainland around Miami.

The geological details of the report need not be dwelt on here. Suffice it to say that the underlying strata described are mostly limestone, ranging in age from Upper Eocene or Lower Oligocene to Recent, and the surface is mostly covered with sand, which may be partly residual and partly a comparatively recent deposit. In the discussion of probable recent changes of sea-level along the coast there is no mention of Dr. D. W. Johnson's observations on the subject, some of which were published a year or two before. On page 102 there is a curious error, repeated from the Second Annual Report. It is there stated that W. C. Kerr and Elisha Mitchell visited Tampa in 1884. Dr. Mitchell died in 1857, and probably never knew Kerr or saw Florida!

There is much less correspondence between the geological divisions shown on the large map and easily recognized geographical divisions than one finds in the other southeastern states, but with the increase of knowledge the discrepancies will probably diminish. The mapping of the coastward portion of the Gulf hammock region, from Jefferson County to Hernando County, as Pleistocene and Recent seems ill-advised, for outcrops of Tertiary limestone just like those a little farther inland abound in the strip thus mapped and even on the bottom of the Gulf of Mexico near by, as was noted by Col. J. L. Williams in his "Territory of Florida" in 1837. The limestone even forms a few natural bridges in the southern part of Jefferson County.

Like its predecessor in the state geological report, the geological map shows topography by means of contours (with a 50-foot interval), and remarkably well considering the thinly settled condition of the state and the fact that not 10 per cent of it is yet covered by topographic surveys.

From the section devoted to underground water the reader can learn that Florida is noted for its large limestone springs (one of which is probably the largest spring in the world). Flowing artesian wells are fairly common in the eastern half of the peninsula and near the west coast, and some of those in Brevard County have a static head of about 50 feet. The water in some of the deep wells in Volusia, Brevard, and Osceola Counties and in all hitherto drilled at Key West is rather salty. In this part of the report there seems to be nothing about the temperature of the air or the predominance of summer rains in all parts of the state; matters which naturally have some bearing on the distribution and depth of ground water.

A few errors and omissions in the county descriptions may be noted here, with the pages on which they occur.

263. Alachua County is not in the lake region, except perhaps a narrow strip at its eastern edge.

269. The highest point mentioned on Trail Ridge is 210 feet. Elevations of about 238 feet a few miles farther south were reported in the *American Journal of Science* (Vol. 67, p. 408) in 1854, and in *U. S. Geological Survey Bulletin 516* (p. 17) in 1912 (see *6th Ann. Rept. Fla. Geol. Survey*, 1914, p. 329, footnote).

287. The water of Ichetucknee Spring is described as amber-colored. The reviewer pointed out in the 3d annual report of the Florida survey (p. 284) at the beginning of 1911 that that can hardly be its normal condition.

342, 343. "Big" Spring near Okahumpka should be Bugg Spring.

The names of Lake Okeechobee, Okefinokee Swamp, Ocklocknee River, Hillsborough Inlet, Hillsborough River, and St. John's County are spelled differently from local usage and therefore presumably wrong; but curiously enough, Hillsborough County and St. John's River are spelled correctly throughout (except for omitting the apostrophe from the latter, which is not a serious error).

Plate 3A is from a photograph taken by the reviewer on July 22, 1910, but there is no mention of that fact, or that the sink-hole there depicted was less than two days old at the time. Plate 4A is entitled "Sink of Santa Fe River," but it is really the "rise," where that river emerges from its subterranean course, and it is correctly labeled in the Second Annual Report. It is not quite so much out of plumb in the later publication, however. Plate 11B seems to be upside down. The "sandstone of uncertain age" in plate 12A seems to be identical with the Altamaha grit of Georgia, as was pointed out by the reviewer in 1911 (*Torrey*, Vol. 11, 1911, April, p. 95. See also *6th Ann. Rept. Fla. Geol. Survey*, 1914, p. 201).

There is no separate bibliography, but nearly one hundred earlier papers are referred to in footnotes or otherwise. Over one-third of these belong to the decade immediately preceding the publication of the authors' first report on Florida geology, four years earlier, but only five or six fall between the two reports. This last probably indicates that a considerable time elapsed between the writing and printing of the one under consideration.

ROLAND M. HARPER.

ANDREWS, D. M. De Soto's route from Confitachequi, in Georgia, to Cosa, in Alabama. Maps, bibliogr. *American Anthropologist*, Vol. 19, 1917, No. 1, pp. 55-67.

BOUCHER, C. S. The ante-bellum attitude of South Carolina towards manufacturing and agriculture. *Washington University Studies*, Vol. 3, 1916, Part 2, No. 2, pp. 243-270.

DIXON, H. M., AND H. W. HAWTHORNE. An economic study of farming in Sumter County, Georgia. 64 pp.; diags. *U. S. Dept. of Agric. Bull. No. 492*. Washington, D. C., 1917. [This bulletin is a report on an exhaustive study of farming in a representative county in the cotton belt.]

GELBERT, L. N., edit. Facts about Georgia: A state rich in resources and opulent in opportunities. 277 pp.; maps, ill., index. Foote & Davies Co., Atlanta, 1916. \$1.00. 10½ x 8. [A popular account of the State's resources written by various authorities and containing a large amount of information of geographical importance. The sections of chief interest are "Forest Resources of Georgia," "Mineral Resources," "Altitudes, Population, and Farm Ownership," and "Cotton."]

LANGFITT, WM. C. Progress of inland waterways in Savannah district. *Rept. of Proc. of the Eighth Ann. Convention of the Atlantic Deeper Waterways Assoc.*, pp. 177-182. Philadelphia, 1915.

MARSHALL, R. B. Spirit leveling in North Carolina, 1896 to 1914, inclusive. 71 pp.; index. *U. S. Geol. Survey Bull. 646*. Washington, D. C., 1916.

SOUTH AMERICA

PARAGUAY, URUGUAY, ARGENTINA, CHILE

MARTINEZ, A. B., AND MAURICE LEWANDOWSKI. **Argentinien im zwangstigsten Jahrhundert.** Nach der vierten Auflage des französischen Originals übersetzt von Frank Kars. xlviii and 354 pp.; maps. F. A. Perthes, Gotha, 1912. Mk. 8. 9 x 6.

It appears that about 1910 England had 935 million dollars invested in the Argentine Republic, France 390, and Germany 200. On account of the close sympathy between the Republic and France, it was desired to attract larger French investments. The present book was written to present the attractiveness of the Argentine to Frenchmen with capital. It was originally written in French. The authors are an Argentine official and statesman and Dr. Maurice Lewandowski, who is stated to have been sent out to study the situation as the representative of the Comptoir National d'Escompte of Paris. They report huge and continuous increases of crops as well as areas put under crops, continued increase of animals of all sorts except sheep, which demand too much space and have therefore to yield to the demand for agricultural land, and continued increase of population and prosperity. Half of the Argentine territory, they say, can be made to serve for grazing or stock raising in about equal proportions, and the country can and certainly will greatly increase its population and its production of grains, alfalfa and live stock. But they also report that the immigrant does not remain in the country, as he should for its best interest; too often he returns to Europe after each harvest, because the land is not made easy enough of acquisition. Slow, vexatious, and difficult is the purchase of land by the poor man. This is a serious drawback to the expansion of Argentine agriculture. Education has a long road to go before it reaches a proper status, a status that will enable the Argentine citizen to look level-eyed at the citizen of the United States. The nation is too much a borrower, too little a saver. Surpluses are too often flung into further expansion instead of being devoted to consolidating what has been gained. National expenditures are altogether too large. Speculation, chiefly in land, reaches ever dizzier heights, yet it is founded on substantial values. Even the highest sales-figures quoted rarely reach forty or fifty dollars an acre. The reviewer recalls the old assessment of "camp" lands about Cordoba in 1884 at \$400 the league of *nine square miles*, and how excessive seemed the increase to \$12,000 the league when water became available for it in the Rio Primero works. Yet the new price is but two dollars an acre!

The investigations of these authors are doubtless sound economically and financially, but in no geographic sense scientific. The real basis for judging the availability of Argentine lands is the local rainfall, of which the book takes no account. A single page covers the whole account of rainfall: "the rain has no constant character," p. 26. Doubtless because this important matter is ignored, the portion of the republic that may raise crops or stock is put too high.

MARK JEFFERSON.

LEHMANN-NITSCHKE, ROBERT. **El problema indígena: Necesidad de destinar territorios reservados á los indígenas de Patagonia, Tierra del Fuego y Chaco según el proceder de los Estados Unidos de Norte América.** *Anal. de la Soc. Científica Argentina*, Vol. 80, 1915, No. 5-7, pp. 385-389. [Paper read at the Pan-American Scientific Congress of Buenos Aires in 1910.]

MATTA, J. G. **Bosquejo del estado actual de la industria minera del cobre en el extranjero i en Chile.** 130 pp. Soc. Nacl. de Minería, Santiago de Chile, 1915.

MOLLO, ANTONIO. **L'Argentina nella crisi economica mondiale.** *Italica Gens*, Vol. 6, 1915, pp. 89-94. Torino.

ORMEZZANO, VINCENZO. **Antofagasta.** *La Geogr.*, Vol. 4, 1916, No. 4-7, pp. 164-186. Novara.

OSSA, I. D. **Depósito de molibdeno i tungsteno de Campanani, Arica.** *Bol. Soc. Nacl. de Minería*, No. 223, Vol. 28, 1916, Ser. 3a, pp. 202-213.

RASSMUS, J. **Rasgos geológicos generales de las sierras pampeanas.** 18 pp. *Bol. Direcc. Gen. de Minas, Geol., e Hidrol.*, Minist. de Agric., No. 13, Ser. B (Geol.). Buenos Aires, 1916.

SCHULTZ, L. G. **Resultado de las observaciones del magnetismo terrestre.** 12 pp.; maps. *Bol. Oficina Meteorol. Argentina No. 5*. Buenos Aires, 1914.

SINGEWALD, J. T., JR., AND B. L. MILLER. **The genesis of the Chilean nitrate deposits.** *Bibliogr. Econ. Geology*, Vol. 11, 1916, No. 2, pp. 103-114. [Abstracted in the December, 1916, *Review*, Vol. 2, p. 465.]

STONE, J. P. **The Chilean nitrate industry.** Ills. *The South American*. Vol. 5, 1916, No. 1, pp. 12-13 and 19.

SWAN, A. D. **Some ports on the west coast of South America and their future development.** *Papers of the Amer. Assoc. of Port Authorities*, Vol. 5, 1916, Part 1, pp. 31-40. [The author has prepared plans for the development of the North Chilean ports of Antofagasta, Coloso, and Mejillones. On his approved plans Antofagasta will remain the principal shipping port despite the vastly superior natural harbor of Mejillones. Besides the consideration of the present status of Antofagasta "it must be borne in mind that, in order to get to Mejillones from the interior by rail with a reasonable gradient, it [freight] would have to be taken past Antofagasta, a distance of 69 kilometers."]

THIERRY, MAURICIO DE. **Ensayo de clasificacion de las aguas minerales de la República Argentina.** *Anal. del Minist. de Agric.*, Vol. 10, 1915, No. 3, pp. 1-150.

— **Uruguay, The mineral resources of.** *South American Journ.*, Vol. 80, 1916, No. 19, p. 382; No. 22, p. 445.

VEGA GALLO, HERMÓJENES. **Reseña sobre los trabajos en el mineral de El Tofo.** *Bol. Soc. Nacl. de Minería* No. 219, Vol. 27, 1915, Ser. 3a, pp. 434-439. Santiago de Chile. [Mine near Coquimbo, Chile.]

WILLIS, BAILEY. **The awakening of Argentina and Chile.** *Ills. Natl. Geogr. Mag.*, Vol. 30, 1916, No. 2, pp. 121-142.

— **Beagle Channel: Cape San Pio to Gable Island.** 1:75,000. *U. S. Hydrogr. Office Chart No. 2207.* Washington, D. C., July, 1916.

— **Beagle Channel: Gable Island to Lapataia Bay.** 1:75,000. *U. S. Hydrogr. Office Chart No. 2208.* Washington, D. C., July, 1916.

— **Guaitecas Islands. From a Chilean survey in 1904.** 1:100,000. *U. S. Hydrogr. Office Chart No. 2339.* Washington, D. C., July, 1916.

— **Guapiquilan Islands (off the south coast of Chiloé). From a Chilean survey in 1896.** 1:41,000. *U. S. Hydrogr. Office Chart No. 1747.* Washington, D. C., July, 1916.

— **Papudo Bay. From a Chilean survey in 1901.** 1:29,000. *U. S. Hydrogr. Office Chart No. 2227.* Washington, D. C., July, 1916.

— **Paraná and Uruguay Rivers, Entrance to the. From Argentine surveys between 1901 and 1910.** 1:100,000. *U. S. Hydrogr. Office Chart No. 2704.* Washington, D. C., July, 1916.

— **Paraná River: Caalayti Sand to Corrientes. From a British survey in 1847.** 1:85,000. *U. S. Hydrogr. Office Chart No. 2710.* Washington, D. C., July, 1916.

— **Paraná River: Paraná to Caalayti Sand. From a British survey in 1847.** 1:84,000. *U. S. Hydrogr. Office Chart No. 2709.* Washington, D. C., July, 1916.

— **Paraná River: Paraná Guazu to Ceibal. From Argentine surveys between 1901 and 1910.** 1:100,000. *U. S. Hydrogr. Office Charts No. 2707 and 2708.* Washington, D. C., July, 1916.

— **Punta Arenas Road. From a Chilean survey in 1897.** 1:25,600. *U. S. Hydrogr. Office Chart No. 2081.* Washington, D. C., July, 1916.

— **Quilan Cove. From a Chilean survey in 1896.** 1:10,000. *U. S. Hydrogr. Office Chart No. 1747.* Washington, D. C., July, 1916.

— **Taltal, Port. From a Chilean survey in 1903.** 1:11,800. *U. S. Hydrogr. Office Chart No. 2334.* Washington, D. C., July 7, 1916.

— **Uruguay River: Concepcion del Uruguay to Concordia. From Argentine surveys between 1901 and 1910.** 1:50,000. *U. S. Hydrogr. Office Chart No. 2706.* Washington, D. C., July, 1916.

— **Zapallar, Port. From a Chilean survey in 1901.** 1:29,000. *U. S. Hydrogr. Office Chart No. 2227.* Washington, D. C., July, 1916.

EUROPE

BRITISH ISLES

STEBBING, E. P. **British forestry: Its present position and outlook after the war.** xxv and 257 pp.; ill., index. John Murray, London, 1916. 6s. 8 x 5.

The problem of finding an adequate and marketable supply of timber for house-building on a vast scale after the war has engaged the attention of this well-known authority in forestry. A strong afforestation policy should be adopted. For immediate purposes Russian forests offer the strongest hope. From a geographer's viewpoint the most valuable chapters deal with the forests of Russia in Europe and the forests of Finland, Siberia,

and Turkestan. These chapters contain sections on the topography, climate, forest resources, exports, and imports of each region with reliable statistics. A short chapter on the cedar trade of Asiatic Russia contains invaluable material on the gathering of the seed of the cembra pine, material which the geographer would find it exceedingly difficult to get elsewhere. Certainly nowhere else can be found so careful and comprehensive an exposition of the timber imports and exports of the British Isles in 1915. Professor Stebbing's book not only serves the immediate needs and emergencies of the time but also contributes to a broader knowledge of the principles and economics of forestry, the crop aspects of the world's timber supply, and the place of trees in the new commercial and social age to follow the present war.

BONACINA, L. C. W. *The great snowstorms of 1916.* *Symons's Meteorol. Mag.*, No. 603, Vol. 51, 1916, April, pp. 37-40.

— *British Isles, The.* viii and 210 pp.; maps, diagrs., ills. (Cambridge Geographical Readers, III. Edit. by G. F. Bosworth.) University Press, Cambridge, 1915.

— *British rainfall, 1915.* By Dr. H. R. Mill and Carle Salter. *Nature*, No. 2453, Vol. 98, 1916, Nov. 2, p. 168. [A review.]

CARMICHAEL, ALEXANDER. *Grazing and agrestic customs of the outer Hebrides.* *Celtic Rev.*, No. 37, Vol. 10, 1914, pp. 40-54; No. 38, 1915, pp. 144-148. [Description of archaic customs surviving amongst the crofters of the Outer Isles. Arable lands and peat mosses are re-distributed periodically according to lot. Each season the fishing grounds are apportioned in the same way. Certain obligations incurred by the crofters themselves, i. e. the wages of the constable elected, are paid in kind. Each community (townland) has its own shepherd and herdsman. Many of the ancient customs, however, are now disappearing.]

CHAPMAN, E. H. *The relation between atmospheric pressure and rainfall at Kew and Valencia observatories.* Diagrs. *Quart. Journ. Roy. Meteorol. Soc.*, No. 180, Vol. 42, 1916, pp. 289-299. [The Valencia referred to here is in Ireland not Spain.]

CLARK, KEITH. *The spell of Scotland.* 345 pp.; map, ills., bibliogr., index. The Page Co., Boston, 1916. \$2.50. 8 x 6.

CLOSE, C. F. *Notes on the geodesy of the British Isles.* 33 pp., maps, index, bibliogr. *Ordnance Survey, Prof. Papers, New Series*, No. 3. London, 1914.

DEELEY, R. M. *The fluvio-glacial gravels of the Thames Valley.* Map, diagr. *Geol. Magazine*, Sixth Decade, Vol. 3, 1916, No. 2, pp. 57-64; No. 3, pp. 111-117.

SHAW, NAPIER. *Hourly values from autographic records: Geophysical section, 1913.* Comprising hourly readings of terrestrial magnetism at Eskdale Observatory and summaries of the results obtained in terrestrial magnetism, meteorology, and atmospheric electricity chiefly by means of self-recording instruments at the observatories of the meteorological office. 97 pp.; diagrs. *British Meteorol. and Magnetic Year Book, 1913*, Part 4, Sect. 2. Edinburgh, 1915.

WARD, E. M. *The Cinque Ports and their coastline.* Maps, bibliogr. *Geogr. Teacher*, No. 45, Vol. 8, 1916, Part 5, pp. 306-311; No. 46, Part 6, pp. 360-374.

THE LOW COUNTRIES, LUXEMBURG

LÖHNIS, TH. P. *De Maatschappij voor Scheeps- en Werktuigbouw "Fijenoord" te Rotterdam, voorheen de Nederlandsche Stoomboot-Maatschappij.* ills. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 4, pp. 133-156.

LOON, H. W. VAN. *The rise of the Dutch kingdom, 1795-1813: A short account of the early development of the modern kingdom of the Netherlands.* xx and 279 pp.; ills. Doubleday, Page & Co., New York, 1915. \$2.50. 9 x 6.

PIRENNE, H. *De Belgische natie. Vragen van den Dag*, Vol. 31, 1916, No. 10, pp. 737-757.

SCHRIJNEN, JOS. *Nederlandsche Volkskunde*, Vol. 2. iv and 361 pp.; map, ills., index. W. J. Thieme & Cie., Zutphen. Fls. 3.75. 10½ x 7.

VAN DER STOK, J. P. *Bijdrage tot de kennis van het klimaat van Nederland.* Diagrs. *Tijdschr. Kon. Nederl. Aardrij. Genoot.*, Vol. 33, 1916, No. 1, pp. 1-29; No. 2, pp. 163-190.

WIEDER, F. C. *Mijn eerste onderzoek in Duitschland naar oud-Nederlandsche kaarten en een belangrijke vondst in Engeland.* *Tijdschr. Kon. Nederl. Aardrij. Genoot.*, Vol. 33, 1916, No. 4, pp. 540-568.

SCANDINAVIA, INCLUDING FINLAND

MADSEN, V. H. O. *Le Service Géodésique du Danemark, 1816-1916*. 46 pp.; maps, ills. *Den danske Gradmaaling No. 16*. Copenhagen, 1916.

General Madsen, Director of the Geodetic Survey of Denmark, has celebrated the centenary of that organization by publishing a brief résumé of geodetic accomplishments in Denmark, together with portraits and succinct biographies of his three eminent predecessors and five maps illustrating the work accomplished.

Except for the first director and a few of the collaborators, all the directors, observers, and calculators have been officers of the army or navy. Denmark joined the International Geodetic Union in 1862 and has made an appreciable contribution to the solution of problems of international interest.

Triangulation had begun in 1765, but systematic work dates from the founding of the Danish Geodetic Service in 1816 under Professor Schumacher, who established the observatory of Altona. Director Schumacher's equipment and work attracted world-wide notice, many celebrated astronomers coming to Holstein to visit him. He inaugurated a grand program of triangulation to cover Denmark and join with Prussia, but his labors were interrupted in 1848 before his program was completed. He originated the *Astronomische Nachrichten* in 1823.

Colonel Andrae resumed operations in 1853 and completed the program in 1884, publishing his results in Volumes 1-4 of *Den danske Gradmaaling*. This completed Denmark's contribution to the determination of the terrestrial spheroid. Andrae's elaboration of his predecessor's observations and his originality in developing geodetic theories along practical lines won him international renown.

Under General Zachariae, 1884-1907, a new program of work began, including precise leveling, latitude and gravity determinations, and an extension of the triangulation net to join with Sweden. He practically finished his program and published his results in Volumes 5-9, but military service prevented him from completing his calculations.

General Madsen was appointed in 1907. He continued practical work, introducing many modern improvements in methods, and in 1912 published as Volume 10 a résumé in French of the first nine volumes. A review of Volume 10 has already appeared (*Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 713-714).

JAMES GORDON STEESE.

SANDSTRÖM, J. W. *Meteorologische Studien im schwedischen Hochgebirge*. 48 pp.; maps, diags. Wettergren & Kerber, Göteborg, 1916. 9½ x 7.

J. W. Sandström has been making personal studies of meteorological phenomena in the mountains of Sweden. This "field work," as it is always the case when it is undertaken by a competent observer, has yielded many interesting facts.

The trip, the results of which are now published, was a short one (December 3, 1913-January 20, 1914). The succession of weather changes met with during the author's tramp through his native mountains is graphically described. The most noteworthy phenomena are analyzed and explained. Local winds, snow squalls, temperature changes, ice conditions, cloud formation, fog—these and many other meteorological conditions are referred to. The author says that there must be few districts in the world better suited for direct observation of dynamic meteorological phenomena than the west side of the northern Scandinavian highland in winter. The most important aids in his work were his "own eyes and feet." Special attention is given to the air movements in the mountains, and several diagrams illustrate the conditions. A few closing paragraphs deal with geological climates. The essential importance of wind in controlling cloudiness and precipitation and in determining life conditions is strongly emphasized, and the controls exercised by topography over air movement and temperature are considered. Geological climates are believed to have been directly controlled by the relief of the earth's surface. When the mountains were highest, glacial climates prevailed. When the mountains were lowered by erosion, warm desert climates prevailed. Variations in the CO₂ content of the atmosphere, depending upon the temperature of the ocean waters, were contributing causes of climatic change. Storms, also, being more violent when the mountains were highest, brought more precipitation at times of most marked relief.

Dr. Sandström's discussion of geological climates is unfortunately very brief. His views upon this subject are clearly affected by what he has himself seen of present conditions of air movement in its relation to topography in Sweden. It would be well if more writers were to start with *present* conditions in their endeavor to explain past climates.

R. DEC. WARD.

— Allmänna Väg- och Vattenbyggnader, av Kungl. Väg- och Vattenbyggnadsstyrelsen, År 1915. viii and 153 pp. Sveriges Officiella Statistik, Stockholm, 1916.

BIRRELL, J. H. Notes on Sweden, with special reference to the forests in relation to industry and commerce. Map. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 5, pp. 227-241.

— Electric energy, the transmission of, from Sweden to Denmark. Maps, *Scientific American Suppl.*, No. 2110, Vol. 81, 1916, June 10, p. 377. [An abstract from *Engineering*, giving various technical details of "the first instance of the transmission of electric power from one country to another by submarine cables." The current is transmitted from Helsingborg to Elsinore.]

— Finland, Statistisk Årsbok för. 669 pp.; map. *Utgifven of Statistiska Centralbyrån*, New Ser., Vol. 13, 1915. Helsingfors, 1916. [Also written in French.]

— Järnvägar, Statens, av Kungl. Järnvägsstyrelsen, År 1915. 246 pp.; maps, diagrs. Sveriges Officiella Statistik, Stockholm, 1916.

LINDROTH, HJALMAR. Estnisk bosättning i Sverige under äldre tider. Map. *Ymer*, Vol. 36, 1916, No. 3, pp. 194-214. [Estonians in Sweden in ancient times.]

— Nedbøriagttagelser i Norge. Vol. 21, 1915. xi and 83 and 66 pp.; maps, diagrs., ills. Norske Meteorol. Inst., Christiania, 1916. [Rainfall observations in Norway.]

RABOT, CHARLES. Le grand lac Vener accessible à la navigation maritime. Map, diagr. *La Nature*, No. 2271, 1917, April 7, pp. 220-222. [Illustrated with a map and profile of the canal. Compare the record item entitled "Extension of the Swedish Waterway System" in the March number of the *Review*, p. 243.]

ROSEN, ERIC VON. Hafva offerplatserna vid Gråträsk, Rautasjaure, och Unna Saivva uteslutande användts af lappar? *Ymer*, Vol. 36, 1916, No. 1, pp. 32-38. [As to whether certain sacrificial places were used exclusively by Laplanders.]

RYDER, C. Meteorologisk Aarvog, 1914. Part II: Faerøerne, Island, Grønland og Vestindien. 85 pp. 1915, Part I: Kongeriget Danmark. 75 pp. Danske Meteorol. Inst., Copenhagen, 1916.

SANDER, G. D. Zeemansgidsen voor de Kleine Vaart. Part 4: De Bothnische Golf. 160 pp.; diagrs., ills., index. Dept. of Agric., 's-Gravenhage, 1914.

— Swedish lake, Ship canal from, to ocean. Ills. *Engineering News*, Vol. 77, 1917, Feb. 22, pp. 297-298. [Abstracted in the March *Review*, p. 243.]

— Topografisk kart over kongeriket Norge. Sheet: Moss. 1:100 000. Surveyed in 1891-1908, revised in 1912. Norges Geografiske Opmaaling 1915, Christiania, 1915. [A portion

of the Christiania fiord district showing excellent examples of partially submerged glacial troughs and small hanging valleys, and especially noteworthy for the prominent terminal moraine near Svelvik which separates Dram Fiord into two parts. For a good description of the moraine, illustrated by photographs and diagrams, see W. C. Brøgger: "Om de senglaciale og postglaciale nivåforandringer i Kristianiafeltet," *Norges Geologiske Undersøgelse*, No. 31, 1901, pp. 131-141. Compare this map with the Narvik sheet, which shows troughs and hanging valleys in more striking manner, and a less prominent terminal moraine dividing the two parts of Rombak Fiord. Some of the best photographs yet published of the fiord coast of Norway may be found in a new quarto series entitled *Grand Géographie Bong Illustrée*, Paris, 1913. In Vol. 3, opposite p. 20, there is a striking photograph of Stavanger Fiord with its dark, lofty, stream-scored walls surmounted by the rolling upland that forms a large part of the surface of Norway. The colored views opposite p. 8, showing coastal scenery, are incomparable. See also the maps in this volume, pp. 6 and 7.—D. W. J.]



ASIA

TURKEY IN ASIA, ARABIA, CAUCASIA, IRAN

SCHWÖBEL, VALENTIN. **Die Landesnatur Palästinas.** (Series: Das Land der Bibel: Gemeinverständliche Hefte zur Palästinakunde im Auftrage des Deutschen Vereins zur Erforschung Palästinas herausgegeben von Professor Lic. Dr. G. Hölscher, Vol. 1, Nos. 1 and 3.) Part I: 56 pp.; Part II: 52 pp. J. C. Hinrichs'sche Buchhandlung, Leipzig, 1914. 9 x 6.

In about one hundred pages Dr. Schwöbel gives an admirable discussion of the physiographic features of Palestine. His work cannot be said to be original, but he has carefully studied the best authorities. He follows the usual method of discussing first the boundaries and general characteristics; then geological structure, climate, hydrography, surface forms, and altitude relations. For the most part he avoids theory and sticks to facts. In regard to the most warmly debated problem in the geography of Palestine, namely, changes of climate, he concludes that the hydrographic conditions have unquestionably changed during historic times, the supply of water being less now than 2,000 years ago. In explanation of this he offers the old hypothesis that subterranean sources of water supply have gradually become exhausted. People who have actually lived from season to season in dry countries are not likely to accept this idea. The volume of the springs changes so rapidly in response to seasons of drought or unusual rain that one can scarcely believe that huge reservoirs of water can have been gradually declining for hundreds of years.

ELLSWORTH HUNTINGTON.

WILLIAMS, W. L. **Armenia, past and present: A study and a forecast.** With an introduction by T. P. O'Connor. xi and 211 pp.; maps, index. P. S. King & Son, Ltd., London, 1916. 3s. 6d. 7½ x 5.

To western peoples but vaguely acquainted with the past of the Near East, this glimpse of Armenia's tragic history will serve as an introduction. A preliminary sketch of the country, written concisely and not overburdened by technicality, leads the reader to graphic passages in the early period. Here as in the later and wider stream of national history, the author provides a mere historical outline; but he succeeds in giving a thoroughly intelligent first lesson. The relation of Armenia to the western world and the role of the inhabitants as early guardians of the more advanced ideals of the West are exhibited.

Concerning modern problems the author has culled from opinions freely aired in the press during the past thirty years, and makes no personal contribution. A partisan of Armenian autonomy, he realizes at the same time that the shifting of Near Eastern problems a few points to the east after the war may convert Asia Minor into a storm-center of the Balkan type. With a past and future clouded alike, the history of Armenia shows what a misfortune it was for its people to inhabit a highway of nations instead of a wayside path.

BLYTH, ESTELLE. **The future of Palestine.** *The Near East*, No. 293, Vol. 12, 1916, Dec. 15, pp. 157-158; No. 294, Dec. 22, pp. 181-182.

CALVERLEY, E. E. **The pearl fishing in the Persian Gulf, where the finest gems in the world are found.** Ills. *Scientific American Suppl.*, No. 2146, Vol. 83, 1917, Feb. 17, pp. 100-101.

CORSI, MARIO. **Il califfato turco in Asia e la rivolta delo sceriffo della Mecca.** *Riv. Coloniale*, Vol. 11, 1916, No. 7, pp. 341-349.

FALEV, P. A. **Compte-rendu d'une mission en Transcaucasie et en Azerbeïdžan pendant l'été 1916.** *Bull. de l'Acad. Imp. des Sci. [de Pétrograd]*, Ser. 6, 1917, No. 3, pp. 171-176. [In Russian.]

GHIBELLINO, D. O. **La Francia e l'Italia in Oriente e in Affrica: La questione dello Jemen.** *Riv. Coloniale*, Vol. 11, 1916, No. 10, pp. 580-587.

HILL, RICHARD. **In the cosmopolitan Caucasus.** Ills. *Travel*, Vol. 28, 1916, No. 2, pp. 26-30 and 46. ["A region that has harbored many nationalities since pre-Roman times—the valley of the seven nations and how the people live."]

JASTROW, MORRIS, JR. **The world's highway.** *The Nation*, No. 2670, Vol. 103, 1916, Aug. 31, pp. 197-200. [The historical struggle for the highway of Asia Minor and Mesopotamia.]

KHARAJIAN, H. A. **Regional geology and mining of Armenia.** 72 pp.; maps, diagrs., bibliogr. The Nerso Press, New York, 1915. 9 x 6.

PACE, BIAGIO. **Le due prime campagne della Missione archeologia italiana in**

Asia Minore. Maps, ills. *Boll. della Reale Soc. Geogr. Italiana*, Vol. 5, 1916, No. 11, pp. 885-907.

ROGERS, R. W. **A history of Babylonia and Assyria.** Vol. I: xx and 542 pp.; map, diagr., ills. Vol. II: xix and 609 pp.; ills., bibliogr., indexes. The Abingdon Press, New York, Cincinnati, 1915. 2 vols. \$10.00. [A praiseworthy book of which the first volume deals with the history of archeological exploration, the geography of the Tigris-Euphrates region, and the modern development of knowledge of its ruins, mounds, and cuneiform records. The geographical sections are by way of explanation, but they are unusually clear and helpful. The constant contrast between the ancient and the modern geography of the Euphrates valley is scholarly in treatment and contributes much high-grade material to a regional study of the valley.]

The second volume treats principally of dynasties, but is full of interesting matter concerning ancient colonists, nomads, plundering and military expeditions, and all the laborious but romantic wars between rival kingdoms through which was spread a knowledge of the arts and sciences of Assyria and Babylon.]

SOUTHARD, A. E. **Aden's trade in gums, spices, oils, and seeds.** *Commerce Repts.*, 1917, No. 24, pp. 376-379. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

THIMM, C. A. **Turkish self-taught, with English phonetic pronunciation.** (Marlborough's Self-Taught Series.) Revised by G. Hagopian. 138 pp.; ill. E. Marlborough & Co., London, 1910. 60 cents. $7\frac{1}{2} \times 5$.

INDIA

JACK, J. C. **The economic life of a Bengal district: A study.** 158 pp.; diagrs. Clarendon Press, Oxford, 1916. 7s. 6d. 9×6 .

This remarkable little book was written by a member of the Indian Civil Service who went home to take part in the war. While in India he had supervised one of the most careful economic studies ever made. With a corps of high-grade native assistants he made a detailed study of the income and expenditures of some 350,000 families in the Bengal district of Faridpur, in the delta of the Brahmaputra and Ganges. A million pages of data had been boiled down to a few tables, but the results had never been published. Fearing that his results might be lost to the world Mr. Jack took advantage of a furlough and in five days wrote this book. In it he not only gives a vivid description of a well-defined geographical province, but sheds a most illuminating light on Great Britain's wise colonial administration. Apparently his work had no immediate connection with the recent projects for increased customs duties on cotton in India, or for India's expenditure of half a million dollars for the world war; nevertheless it has a significant bearing on these questions.

Four-fifths of the two million people of Faridpur depend directly upon agriculture. Although the flat delta is inundated for months each year, population averages 900 per square mile. The southwestern part forms a shallow lake for eight months. Yet even there 800 people per square mile live on little islands which they themselves have heaped up. The period of steady farm work lasts only three months. The rest of the time, having harvested their rice and jute, the people have little to do except to fish. Sometimes the farmers of fairly prosperous districts hire those from less prosperous places to cut their rice crops for one-sixth of the product, while they themselves go to more favored places and work for one-fifth of the crop. The people are mild and quiet, as befits the climate, and Mr. Jack comments on the lack of laughter and of rough games among the boys. Litigation, however, is distressingly common, and lawyers profit outrageously.

For his economic discussion Mr. Jack divides the population into four classes whose numbers and weekly income per family are as follows:

(1)	Persons living in comfort (49%)	9s. 4d. per week
(2)	" " below comfort (28%)	6s. " "
(3)	" " above indigence ($18\frac{1}{2}\%$)	4s. 3d. " "
(4)	" " in indigence ($4\frac{1}{2}\%$)	3s. " "

Among the indigent there are practically none who suffer from hunger. Everyone can fish and the Bengalis are always ready to give food to the poor.

The most significant part of Mr. Jack's book is his discussion of indebtedness and especially taxation. Nearly half of the people are in debt, although most of the debts are small. The great difficulty is the enormous rate of interest, 30 or 40 per cent compounded semi-annually. Before the war in the more advanced countries of Europe the average revenue of the government from all sources ranged from \$32 or \$33 per head in England and France to about \$18 in Italy, while in Japan it amounted to \$8. In Farid-

pur it was only 90 cents per person. Nevertheless wages in every occupation in the country districts of Japan appear to be at a lower level than in Bengal. In southern Italy in the purely agricultural districts the income of the average peasant may be larger than that of the people of Faridpur, but it is nothing like twenty times as great, as it would have to be in proportion to the taxes. This leads to Mr. Jack's main conclusion. "Civilized government is not a cheap thing, and the recognized law is that the poorer the country the greater the cost of its government. India is an amazing exception. Bengal is incontestably the most lightly taxed of civilized countries It is probable that there is no other in which the burden of taxation is not twice or three times as great as it is in Bengal." In return for this light taxation the Indian bureaucracy has supplied India with cheaper railway communication than any possessed by European countries, has provided for her the greatest irrigation works in the world, and has created a judicial system whose fairness and expedition are unsurpassed. It has maintained order and security of life and property in the most unlikely conditions, and has grappled successfully with widespread failure of crops, the most difficult problem which any government has ever been called upon to face. Of late years it has also attempted the stupendous labor of providing an ignorant and densely populated country with a modern system of education and sanitation. The only place where the Bengali gets little return for his taxes is in local affairs which he himself manages. Not only is education almost totally neglected, but health, water supply, roads, lighting, and the like are all very poorly managed, and a large part of the taxes is lost in the form of graft.

Mr. Jack's book is more forcible because he does not attempt to eulogize the British policy in India. He simply shows what it has done. Because he deals solely with facts his statements are convincing. If the people of India worked with a tithe of the energy and efficiency of their British rulers that country might be the richest in the world.

ELLSWORTH HUNTINGTON.

HOLDICH, T. H. **The survey link connecting the triangulations of India and Russia.** Ills. *Nature*, No. 2449, Vol. 98, 1916, Oct. 5, pp. 92-94.

— **India, plague investigations in, Eighth report on.** Diags., ill. *Journ. of Hygiene: Plague Suppl.* 3, Vol. 13, 1914, pp. 403-681. Advisory Committee appointed by the Secretary of State for India, the Royal Society, and the Lister Inst., London.

— **India and Russia, Completion of the link connecting the triangulations of, 1913.** vii and 121 pp.; maps, diags., ill., bibliogr., index. *Records of Survey of India*, Vol. 6. Dehra Dun, 1914.

KELWAY-BAMBER, H. **Thirty-five years' advance in Indian railway development.** Diags., ill. *Asiatic Rev.*, No. 26, Vol. 9, 1916, pp. 182-220.

KERSHAW, L. J. **Quinquennial review of forest administration in British India for the period 1909-10 to 1913-14 to which is appended the annual return of forest statistics for the year 1913-14.** 31 pp.; maps, diags. Dept. of Revenue and Agric., Simla, 1915.

— **Meteorological observations taken in the laboratory of the Indian Association for the Cultivation of Science, 1914.** Diags. *Rept. of the Indian Assoc. for the Cultivation of Science for the Year 1914*, pp. 93-107. Calcutta, 1916.

RYDER, C. H. D. **Turco-Persian Frontier Commission.** Map, ill. *Records of Survey of India*, Vol. 9, pp. 164-173. Calcutta, 1916.

S—, —. **India and German trade.** *Asiatic Rev.*, No. 28, Vol. 10, 1916, pp. 414-419; No. 29, Vol. 11, 1917, pp. 100-104.

TODD, J. A. **The world's cotton supply and India's share in it.** *Journ. Roy. Soc. of Arts*, No. 3345, Vol. 65, 1916, pp. 110-131 (discussion, pp. 126-131).

FARTHER INDIA, INCLUDING BURMA

CADET, G. LE. **Bulletin pluviométrique (1) 1914 and (2) 1915.** Maps. Observatoire Central de l'Indochine, Service Météorologique, Phu-Lien, 1915, 1916.

A prime source of meteorological material for the Indo-China region of southeastern Asia. Each volume has a few pages of well-conceived explanatory text, followed by tables and summaries, and a map showing the average yearly rainfall. Except for a belt of heavy rainfall on the eastern coast of the Gulf of Siam the regions of heavy precipitation conform to a notable degree with the topography. The most marked topographic elevation on the peninsula is a range of mountains that runs parallel to and very near the eastern coast. This, combined with a southeastern monsoon, results in a heavy rainfall all along the eastern coast except for a break that corresponds with the plains at Hanoi (lat. 20° N.).

BRENIER, HENRI. Nos grandes colonies et la guerre: Indochine. *Revue des Sci. Polit.*, Vol. 35, 1916, Apr. 15, pp. 145-171.

BRIGGS, L. P. French Indo-China. Ills. *Far Eastern Rev.*, Vol. 13, 1916, No. 1, pp. 32-34. Shanghai.

BRIGGS, L. P. The production of palm sugar in Cambodia. *Commerce Repts.*, 1916, No. 109, pp. 516-517. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

DURANDIN, PAUL. Le pétrole dans l'Indochine française: Indices de l'existence de gisements d'hydrocarbures. *Bull. du Comité des Trav. Hist. et Sci.: Sect. de Géogr.*, Vol. 29, 1914, pp. 40-79. Minist. de l'Instr. Publ. et des Beaux-Arts, Paris.

— French Indo-China, Mining in. Ills. *Far Eastern Rev.*, Vol. 13, 1916, No. 2, pp. 68-69.

LEMOINE, PAUL. Les travaux du Service Géologique de l'Indochine. *La Géogr.*, Vol. 30, 1914-15, No. 4, pp. 288-290. Paris.

MAYBON, C. B. Au sujet de la "Rivière du Tonkin." Map. *Rev. de l'Hist. des Colonies Françaises*, Vol. 4, 1916, Part 3, pp. 257-266. Paris. [Discussion of the fluvial routes to Tonkin in the seventeenth century.]

REGELSPERGER, GUSTAVE. L'Indochine actuelle, d'après l'"Atlas statistique" de M. Henri Brenier. *Rev. Générale des Sciences*, Vol. 27, 1916, No. 6, pp. 178-189.

— Siam, Royal state railways of. Map, ills. *Far Eastern Rev.*, Vol. 12, 1916, No. 9, pp. 365-368. [Director General Weiler's report for the year 2457, A. D. 1914-15.]

— Anam: Fanrang Bay to Tonkin Gulf. 1:800,000. With inset: Entrance to Hue River. 1 in. to 1 mi. (1:70,000). *U. S. Hydrogr. Office Chart 3152*. Washington, D. C., 1916.

— Indo-Chine, Carte de l'. 1:100,000. Six sheets: No. 177, *Kompong-Thom*; No. 178, *Porong*; No. 188, *Kompong-Chlmang*; No. 198, *Oudong*; No. 2 8, *Pnom-Penh*; No. 234, *Can-Tho* (provisional edit., 1915). Service Géogr. de l'Indo-Chine, Hanoi, 1913.

— Malacca, Strait of: Dinding Islands, The, and channels. 1:24,300. *U. S. Hydrogr. Office Chart No. 3738*. Washington, D. C., 1916.

— Malakka Strait: Klang Strait and approaches. 1:50,000. *U. S. Hydrogr. Office Chart No. 3742*. Washington, D. C., 1916.

— Siam, Gulf of: Fukwok Island and channels leading to the anchorages off Kampot. 1:150,000. *U. S. Hydrogr. Office Chart No. 3146*. Washington, D. C., 1916.

— Siam, Gulf of: Kut Island to Riem Bay. 1:275,000. *U. S. Hydrogr. Office Chart No. 3138*. Washington, D. C., 1916.

— Singapore to Kapas Island, Malay Peninsula—East Coast. 1:500,000. *U. S. Hydrogr. Office Chart No. 3131*. Washington, D. C., July, 1916.

OCEANS

— Atlantic and Indian Oceans, Monthly meteorological data for ten-degree squares in the, (1) January-June, 1914; (2) July-December, 1914; (3) January-June, 1915; (4) July-December, 1915. 2 pp. each. *Kon. Nederl. Meteorol. Inst. [Publ.] No. 107*, Utrecht, 1915; 1916.

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AULT, J. P. Magnetic declinations and chart corrections obtained by the Carnegie from Dutch Harbor, Alaska, to Lyttelton, New Zealand, August-November, 1915. *Terrestr. Magnet. and Atmosph. Electr.*, Vol. 21, 1916, No. 1, pp. 15-18.

BABER, ZONIA. The oceans, our future pastures. *Scientific Monthly*, Vol. 3, 1916, No. 3, pp. 258-262. [Discusses the depletion of large sea animals and the desirability of international coöperation in enforcing remedial measures.]

BRUCE, W. S., ANDREW KING, AND D. W. WILTON. The temperatures, specific gravities, and salinities of the Weddell Sea and of the North and South Atlantic Ocean. *Trans. Roy. Soc. of Edinburgh*, Vol. 51, 1915, Part 1, No. 4, pp. 71-109.

BUEN, ODÓN DE. *Première campagne de l'Institut Espagnol d'Océanographie dans la Méditerranée*. 23 pp.; map. *Bull. l'Institut Océanographique* No. 318. Monaco, 1916.

BUEN, ODÓN DE. *Segunda campaña oceanográfica del "Vasco Núñez de Balboa"*. *Bol. Real Soc. Geogr.*, Vol. 57, 1915, No. 4, pp. 515-526. Madrid.

CLARK, A. H. On the temperature of the water below the 1000-fathom line between California and the Hawaiian Islands. *Diagr. Journ. Washington Acad. of Sci.*, Vol. 6, 1916, No. 7, pp. 175-177.

GALLÉ, P. H. On the relation between departures from the normal in the strength of the trade-winds of the Atlantic Ocean and those in the water-level and temperature in the northern European seas. *Diagrs. Proc. Section of Sciences, Kon. Akad. van Wetenschappen te Amsterdam*, Vol. 17, Part 2, pp. 1147-1158. June, 1915.

JORDAN, W. L. The "Challenger" records again, 1875-1915. 8 pp. Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London [1915]. 1s. 8½ x 5½.

MICHAEL, E. L. Continuation of hydrographic, plankton, and dredging records of the Scripps Institution for Biological Research of the University of California (1913-1915). Compiled and arranged under the supervision of W. E. Ritter. *Diagrs., bibliogr. Univ. of California Publs. in Zoology*, Vol. 15, 1916, No. 2, pp. 207-254.

HUMAN GEOGRAPHY

ANTHROPOGEOGRAPHY

FAIRGRIEVE, JAMES. *Geography and world power: A text-book of matriculation standard illustrating the geographic control of history*. x and 356 pp.; maps, index. Hodder & Stoughton, London, 1915. 3s.

The title might lead to the inference that the book was a product of the world war. As a matter of fact the manuscript was finished early in July, 1914, and was thereafter subject to a few verbal changes only. Nevertheless the interest of such a treatment is heightened in a time of almost universal struggle for mastery. The foreword is written by Professor Lyde, who says, "I cannot imagine anyone reading as far as Chapter II and not finishing the book."

The author's thesis, as developed in his introduction, is that human history is mainly a record of the use of energy, an energy which comes from the sun and is developed in forms of heat, winds, and rainfall, all having geographic distribution. The rest of the volume is made up of a series of fruitful and valuable regional chapters. Perhaps the chapter on Rome is as rich in suggestion as any. Italy is more a unit than Greece, but more diversified than Denmark or the Iberian Peninsula. Men from the mainland going south would cross the Etruscan Apennines in the vicinity of Bologna and Florence, and somewhere about Rome would meet foreign peoples that had come from lands beyond the Mediterranean. Among other things we have a statement of plausible geographic reasons why Rome rather than Egypt, Assyria, Phoenicia, or Greece first built great land roads.

The principle of economy in the use of power sometimes seems used in a rather artificial manner, tempting us to the old query as to our present competence for a fully systematic handling of this theme; but the volume is full of good inquiry and suggestions, and is a real contribution to a theme which is elusive and difficult, and must be so, because it involves scarcely less than a philosophy of history.

ALBERT PERRY BRIGHAM.

GEDDES, PATRICK. *Cities in evolution: An introduction to the town planning movement and to the study of civics*. xv and 409 pp.; maps, diagrs., ills., bibliogr., index. Williams & Norgate, London, 1915. 9 x 6.

A good book though somewhat difficult to review owing to the lack of close organization. Geddes has discovered some of the relations of cities to the density of population and develops the idea at length. He perceives the certainty of a Scandinavian renaissance when the "white coal" of its waterfalls drives the wheels of industry and the black coal of the present-day seats of industry is burning out.

A fine contribution is the contrast of *paleotechnic* and *neotechnic* industry, the one bent on making more money, the other bent on making better lives. He sets forth unsparingly the wretchedness pertaining to paleotechnic prosperity—"a vision for the most part of growing infinitudes of mean streets, mean houses, mean back-yards, relieved more or less by bigger ones, too often even duller still." Drunkenness is merely the shortest way out of the paleotechnic town! The neotechnic planner puts well-being above

wealth. There is much about housing and city planning in the book. Much credit is given the Germans for their notable contributions to the city plan, with the reservation that the masses are expected, in Germany, to keep on crowding into tenements.

Professor Geddes' work has consisted largely in advertising the need of town planning, and much space is given here to all methods of bringing it to the notice of the public. A good item is the succinct account of the Edinburgh "Outlook Tower," so long associated with the author's name. Typically cryptic is the note from the preface that "The City and Town Planning Exhibition [has met] total destruction by the vigilant and enterprising *Emden!*" Readers may do their own imagining.

MARK JEFFERSON.

CRILE, G. W. **Man—an adaptive mechanism.** xvi and 387 pp.; diags., ills., index. The Macmillan Co., New York, 1916. \$2.50. 8½ x 6. [Chiefly physiological, but containing an introductory chapter of geographic interest entitled "Adaptation to Environment." Man is still "a changing, modifiable organism" and with changes in his environment have come changes in conditions governing the contest. "The enemy without the clan has been succeeded by the enemy *within* the clan . . ."]

MOORE, G. H. **Population studies by Moore expectancy curve.** *Diagr. Engineering News*, Vol. 76, 1916, Nov. 2, No. 18, p. 844.

SPARROW, H. G. **Territorial waters.** *U. S. Naval Inst. Proc.*, No. 162, Vol. 42, 1916, pp. 447-460. [On the political status of territorial waters.]

WISSLER, CLARK. **"Men of the Old Stone Age"—A review.** Map, diags., ills. *Amer. Museum Journ.*, Vol. 16, 1916, No. 1, pp. 13-21. [Book by Henry Fairfield Osborn, reviewed in the August, 1916, *Review*, Vol. 2, p. 167.]

ECONOMIC GEOGRAPHY

Distribution

DAVIS, J. W., AND T. H. HUGHES. **Geography. Grade 8B. Commercial and political.** ix and 274 pp.; maps, ills. Hinds, Noble & Eldredge, New York, 1915. 8 x 6.

This text is one of a series that have been especially prepared to meet the requirements of the course of study in the schools of New York City. The point of view taken by the authors is that commercial interests should dominate the geography studies of the eighth grade.

The material of this book lacks the vigor that should be found in a text that is to serve as the climax to a grammar school course in geography. For example the meager treatment of the lumber industry, pp. 87-88, is too elementary for an eighth grade. An industry of this importance requires a more extensive discussion than is found in these two short paragraphs. Again, the choice and description of the physical regions in chapter IV are poor. It is a hasty review of the material that has already been carefully studied by pupils of the lower grades. The New England plateau is in the Atlantic Coastal Plain, Appalachian plateaus are represented only by the Alleghany. On the relief map, p. 36, names of the physical regions are used with no attempt to show their definite boundaries, which is a very essential element in industry or commerce. Cleveland, p. 121, does *not* make nearly all the steel vessels used in the lake trade.

The plan of this text is in accord with the present trend in school geography but its material lacks careful organization and the definite details that are necessary for the grammar school pupils if they are to study the geographic meaning of commerce and industry.

W. M. GREGORY.

HEIDERICH, FRANZ, AND ROBERT SIEGER, eds. **Karl Andree's Geographie des Welt-handels, Vol. 3.** x and 572 pp., maps. Henrich Keller, Frankfurt, 1913. 12s. 10 x 7.

It is true that the geography of the German secondary schools as recently taught was patrocenic to a degree that surprised most outsiders. I have seen boys in their teens who would get their North America in a lesson and a half in a Leipzig gymnasium. This shows, however, that there is another side. It also shows by comparison the poverty of American minds in Anglo-Saxon geography, for we have not yet reached the point where we have an effective demand for such books. This Volume 3 covers Australia, New Zealand and Oceania, and the Americas (Latin, "Germanic," and Polar). It has 572 pages. The ordinary page has 450 words, but many pages are in a smaller type that carries 600 words to the page; certainly there are over 250,000 words.

Teutonic systematization crops out in many forms, such as the thorough treatment of the Polar regions (31 pages) and in the old familiar Vereinigten Staaten von—

Venezuela in this case. It will doubtless recall to the minds of the onetime sojourners in the Fatherland the oft repeated question "Are you from the United States of North America or the United States of South America?"

The book is divided as follows: Australia and Oceania, 86 pages; Latin America, 194, of which Argentina gets 13 pages; Central America 26; West Indies 27; Mexico 28. The "North American Union" gets 158 pages, and British America 80.

The method of treatment is the admirable one of giving as much as possible in general treatment before getting down to details, thus South America has 28 pages of general discussion and 114 pages devoted to particular countries. The discussion of the material on each country is topical. In the cases of the several countries of which I read I found the selection of material admirable and meaty, giving the facts necessary for a real economic interpretation, with an interesting collection of facts left over.

J. RUSSELL SMITH.

— **Communication, the history of, or the evolution of communication.** 33 pp. New York Telephone Company. [Text of an illustrated stock lecture on the development of the telephone. A delivery in Brooklyn by Mr. S. V. Gibson was noted in the "Personal" column of the April, 1916, *Review*, Vol. 1, p. 308.]

JEFFERSON, MARK. **The range and township plan of roads.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 3, pp. 80-81.

JOHNSON, E. R. **Probable changes in the foreign trade of the United States resulting from the European War.** *Amer. Econ. Rev. Suppl.*, Vol. 6, 1916, No. 1, pp. 17-24. [Paper read at the 28th Annual Meeting of the Amer. Econ. Assoc., Washington, D. C., Dec., 1915.]

— **Ships, The unprecedented demand for.** Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1917, No. 5, pp. 46-51. [With good photographs.]

WILLIAMS, S. M. **Roads—their influence upon economic and social conditions.** 16 pp.; diagr., ills. Garford Motor Truck Co., Lima, Ohio, 1916. 9 x 6.

HISTORY OF GEOGRAPHY AND EXPLORATION

GWATKIN, H. M., AND J. P. WHITNEY, edits. **The Cambridge Medieval History.** Vol. 1: **The Christian Roman Empire and the foundation of the Teutonic Kingdoms.** xxi and 754 pp.; maps, index. Vol. 2: **The rise of the Saracens and the foundation of the Western Empire.** xxiv and 891 pp.; maps, index. The Macmillan Co., New York, 1913. \$5. 9½ x 7.

These later students in Gibbon's field have corrected his errors of interpretation, have had access to material which was not within his reach, have been trained in a school of the interpretation of historical documents of which he was the founder. But we must admire the more the depth of his research and the genius with which he presented the story of the decadent empire and the vigor of the barbarian people founding a new state upon ruins. The first volume of this new history is a monument to Gibbon. The second brings us to the reign of Charlemagne and the creation of the Holy Roman Empire, the vigorous empire of the Franks and therefore of folk with whom our kinship is a matter now of sentiment rather than of an intellectual comprehension of the Indo-Germanic community of origin.

WILLIAM CHURCHILL.

LAVEILLE, E. **The life of Father de Smet, S. J. (1801-1873).** Authorized translation by Marian Lindsay. Introduction by Charles Coppins. xxii and 400 pp.; ills., index. P. J. Kenedy & Sons, New York, 1915. \$2.75. 9 x 6.

Father de Smet is the "Marquette" of the Indians of the Great Northwest. He was a mission builder, a traveler, a lover of the Indian and his ways, and always a champion of the red man in his grievances against the whites. His missionary labors began at Florissant near St. Louis in 1823. In 1838 he established a mission among the Potawatomes, then in eastern Kansas. In 1841 he settled the Blackfeet Indians about a mission near Missoula, Montana, and in 1844 opened a mission on the Willamette River. His journeys in North America took him from Baltimore to the mouth of the Columbia and northward to the Hudson's Bay Company's post at Fort Edmonton. In the Indian wars that followed the great "white conquest" that dispossessed the Indian of his lands, Father de Smet was invaluable on many occasions in bringing peace between the whites and the enraged and desperate Indians. His work among the Indians was constructive. Through his efforts civilization marched hand and hand with the Faith, for he taught the red men to till the soil and thus prepare themselves for the advanced economic life that would surely follow the encroachment of the whites.

The work is based primarily on the letters and documents of Father de Smet. The author had a wealth of original material at hand. Throughout there are frequent quotations from Father de Smet's letters. One gets an idea of the difficulties of travel in frontier days in the Northwest, though in this respect the book presents nothing that is new. Like the Jesuits of the Great Lakes, Father de Smet was a student of Nature and made collections of plants, insects, and minerals, but nothing of this valuable work appears in the book. In this respect the book is far inferior to the admirable Jesuit Relations and to the original published letters of Father de Smet (see "Life, Letters, and Travels of Father de Smet," edited by H. M. Chittenden and A. T. Richardson, New York, 1904). Moreover, the author may be accused, with all fairness, of being prejudiced in his interpretation of many historical facts. His opinion of the labors of the Protestant missionaries in the Northwest is unworthy to say the least. His discussion of the dealings of the United States government with the Indians and of the developments of the Grant peace policy is wholly one-sided. One does get, however, the story of the struggle of the Indians against the ruthless advance of the white from the Indian point of view.

A. E. PARKINS.

NORTHUP, G. T., edit. and transl. **Amerigo Vespucci letter to Piero Soderini, Gonfaloniere. The year 1504.** 116 pp.; diagr. **Mundus Novus letter to Lorenzo Pietro di Medici.** 13 pp.; diagr. (Vespucci Reprints, Texts and Studies, IV and V.) Princeton University Press, Princeton, and Humphrey Milford, Oxford University Press, 1916. \$1.25 and 75 cents. 8½ x 6.

Few topics relating to the first discoveries in South and Central America present greater perplexities than the four voyages described in the celebrated letters of Amerigo Vespucci. Some investigators regard them as apocryphal, others as genuine, but mendacious, others as genuine and truthful. The discrepancy existing among the different savants is, one might say, disconcerting. (See e. g., "Americus Vespucci, Leben," etc. Hamburg and Leipzig, 1748; Vizeconde de Santarem "Carta del Exemo. Sr. . . . , archivero mayor del Reyno de Portugal, sobre los viajes que Vespuccio," etc., in "Colección de Documentos Inéditos," Vol. 39, Madrid, 1883; "Researches respecting Americus Vesputius, and his Voyages," translated by E. V. Childe, Boston, 1850; and Henri Vignaud, in *Journal de la Société des Américanistes de Paris*, Vol. 8, 1911.)

Above all, it is necessary here to remember that the Vespucci letters constitute up to this very moment the only source of information we possess as to several voyages and exploring expeditions accomplished between the years 1499 and 1503 by the Spaniards and by the Portuguese in the New World. The so-called first voyage, said to have been carried out between 1497 and 1498, we will dismiss from this brief abstract and, leaving that complicated question to be treated in a special paper, state merely incidentally, that it is nothing else than the voyage undertaken in 1499 by Alonso de Hojeda, who then was acting upon letters patent granted to him by the sovereigns of Castile.

Reverting to the Vespucci letters, it is not less important to remark that the writings of the Florentine concerning the newly-discovered countries beyond the ocean and referring to the exotic people he had therein encountered, were during many years the favorite literature of intellectual Europe. The letters were soon translated into most cultural languages, thus circulating widely the whole continent over. Between 1504 and 1505 eleven editions had successively appeared of the Medici Letter, or "Mundus Novus." These editions as well as many other Latin and Italian editions were again and again re-translated and reprinted. Hence we know more than thirty editions in Latin, in Italian, in German, and one even in Dutch (only copy said to be extant is in the John Carter Brown Library, Providence, R. I.), printed between 1504 and 1509. Those prints, and many others akin, now bibliographical curiosities, were but mere "broad-sides," which had been issued and circulated with the unmistakable purpose of keeping informed the general public of important and at once interesting events that now and then had happened abroad. They were commonly in 8vo, or in small 4to, now with numbered pages or folios, now simply bearing signatures in the right or in the left corner below, on the recto of the folio, often without colophon and without mark of the printer, nor water mark in the paper, a circumstance that of course hinders bibliographical investigation; some of them adorned with wood-cuts copied from originals inserted in similar prints, as e. g. Columbus letters, and so forth.

Furthermore, being "sensational literature," and having been destined, as it seems, for mere commercial purposes, the different translations and editions had suffered at the hands of translators and even of editors and printers. Vespucci's heavy style and somewhat confused diction intermixed with a strange terminology, "barbarisms," of course led to all kinds of speculations. Omissions, additions, interpolations, misreadings, and the subsequent mistakes and erroneous interpretations, even entirely false translations, and so on, occur in most editions. There can be no doubt that the texts on which the

modern historian generally bases his judgments, as Mr. Northrup very correctly remarks, "are vastly different from those which left the author's hand" (p. 1). He adds: "The extant versions of these must be critically examined, collated and classified; critical texts must be established before historians can hope to form accurate judgments based upon Vespucci's writings." Thus the critical study of the Soderini letter, "treated solely in its philological aspects," constitutes the scope of the important investigation published by Princeton University.

This premised, the author dedicates over forty pages to a detailed and most conscientious investigation as to the "Quellenverhältnis" of the Florentine print (1504), the Magliabechiana manuscript and the Hylacomylus version. According to Mr. Northrup, the Italian versions can be traced back to a Spanish original; and the Hylacomylus edition goes back to an Italian original through some French(?) version. To sum up, he amply proved what the compiler of the "Paesi nuovamente retrouate" had explicitly observed in 1507: "... fo de lengua spagnola interpretato in idioma romano." More or less the same statement the student may read in the colophon of certain editions of the Vespucci letters, printed between 1505 and 1506 at Augsburg (?).

Though it is far from our mind to minimize the all-important investigation of Mr. Northrup, we ought nevertheless to observe that the Venetian ambassador Angelo Trevisan di Bernardino sent to Venice only Peter Martyr's *First Decade*, which in 1504 was issued under the title of "Libretto de tutta la navigatione de re de Spagna," etc. Perhaps it might have been useful to glance over the Vespucci manuscript of the Biblioteca Nazionale at Florence, as published by Guglielmo Berchet ("Raccolta Colombiana," Part III, Vol. 2, Rome, 1893, pp. 136-170), in which is also to be found the letter of Vespucci addressed to Laurentius Petrus Franciscus de Medicis (pp. 123-135).

RUDOLPH SCHULLER.

— Addresses at memorial services in honor of Dr. E. W. Hilgard, University of California, January 30, 1916. 50 pp.; ills., bibliogr. Reprinted from the *Univ. of California Chronicle*, Vol. 18, 1916, No. 2, Berkeley. [Compare the sketch "The Geographical Work of Dr. E. W. Hilgard" by R. M. Harper in the *Geogr. Rev.*, Vol. 1, 1916, pp. 368-370.]

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RECENT EXPLORATIONS ON THE CANADIAN ARCTIC COAST*

By RUDOLPH MARTIN ANDERSON

Chief of the Southern Party, Canadian Arctic Expedition, 1913-1916

The Canadian Arctic Expedition consisted of two main divisions, the Northern Party, commanded by Vilhjalmur Stefansson, and the Southern Party, under my direction. The Northern Party was to devote its chief attention to the Beaufort Sea in the region west of the Parry Archipelago and north of Alaska and Yukon Territory. The Southern Party planned to explore the northern coast of Canada between Cape Parry (124° W.) and Kent Peninsula (108° W.). It was arranged to have its surveys extend inland about 100 miles and also cover the southern and eastern portions of Victoria Island. The scope and variety of the scientific work called for a staff of specialists, and we were fortunate in securing trained and experienced men whose devotion to the arduous and prolonged field work is a token of the value of their results.¹

We cleared from Nome in the gasoline schooner *Alaska*, July 19, 1913, reaching Point Barrow on August 19, after some difficulty with gales in Bering Sea and Kotzebue Sound. The gasoline schooner *Mary Sachs*, an

* Published by permission of the Deputy Minister, Department of Mines, Ottawa, Canada.

¹ The Southern Party included one geologist, Dr. J. J. O'Neill of the Canadian Geological Survey; two topographers, Mr. Kenneth G. Chipman and Mr. John R. Cox of the Topographic Division of the Geological Survey; two anthropologists or ethnologists, Mr. D. Jenness of New Zealand, an Oxford man with field experience in New Guinea and elsewhere, and M. Henri Beuchat of Paris, who had gained distinction by writings on American archeology; a meteorologist and magnetician, Mr. William Laird McKinlay of Glasgow University; a marine biologist who also studied the plants and insects, Mr. F. Johansen, recently of the Department of Agriculture at Washington, and a former member of the Danish East Greenland Expedition, under the late Mylius Erichsen; a photographer and cinematographer, Mr. George H. Wilkins of Adelaide, Australia; and the leader, who, as a zoölogist of the Geological Survey, was to study birds and mammals and collect specimens for the Victoria Memorial Museum at Ottawa.

Owing to the complications which arose over our not connecting with the *Karluk* at Herschel Island, one of the anthropologists, Mr. Beuchat, and the meteorologist, Mr. McKinlay, were not able to join the Southern Party, and the cinematographer, Mr. Wilkins, was able to be with us for only a small part of the time. Mr. Jenness was able to cover most of the proposed field, however, and, by division of labor, complete meteorological observations were obtained. The magnetic instruments were lost on the *Karluk*, and that branch of science was not represented in the final results.

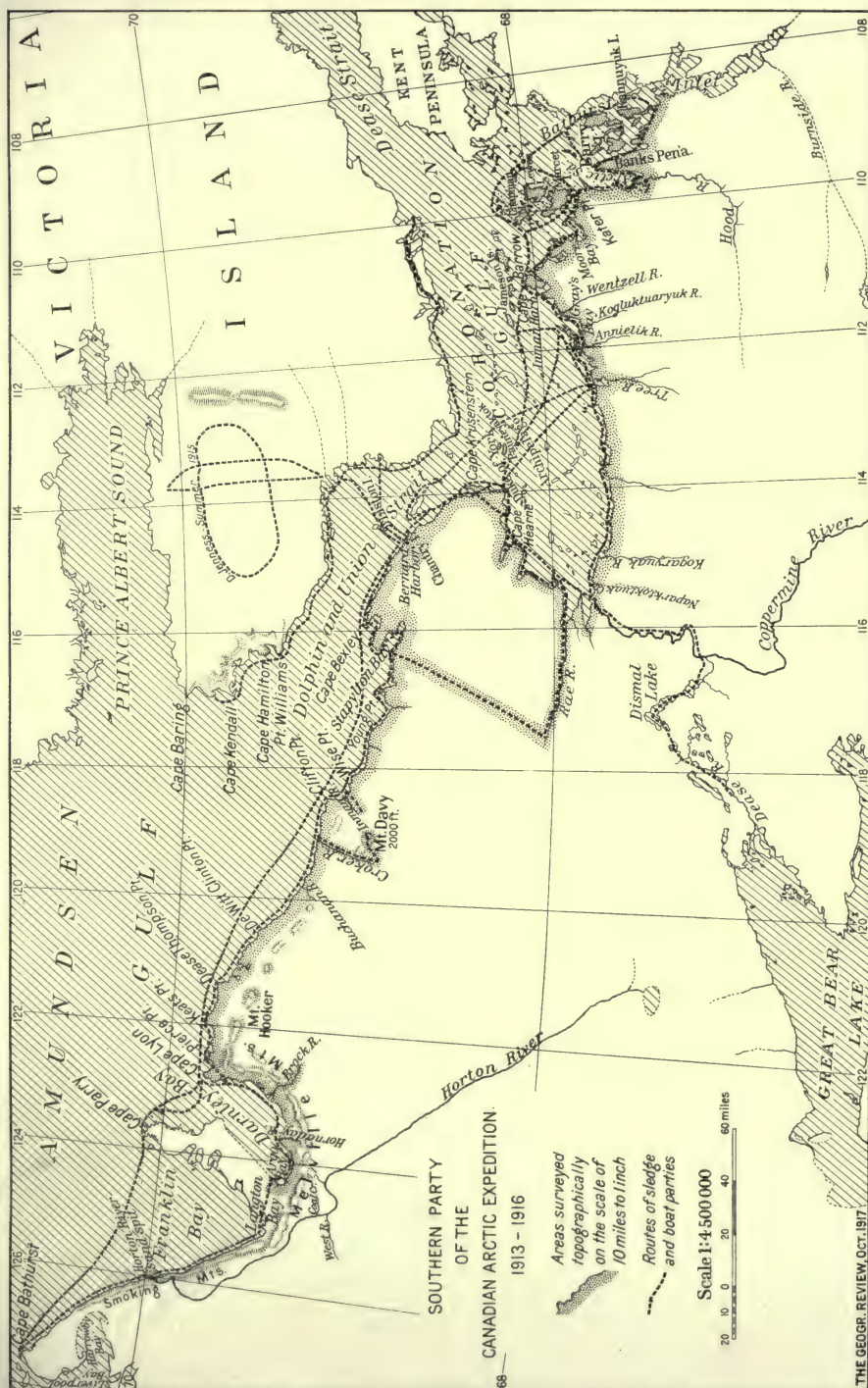


FIG. 2.—Map of a portion of the Arctic coast of northwestern Canada showing in detail the field of activity of the Southern Party of the Canadian Arctic Expedition of 1913-16. Scale, 1:4,500,000.

auxiliary freighter for the expedition, sailed about the same time. Like most vessels starting out for a long Arctic sojourn we were overloaded. In addition to our scientific equipment we had provisions for three years and various supplies, which included almost everything from a needle to an anchor. The decks were encumbered with lumber, sledges, dogs, dredges, and all the miscellaneous gear that was dumped on top because there was nowhere else to put it.

East of Point Barrow we found the Arctic Ocean practically filled with heavy ice. In that part of the world there are no true icebergs; but enormous pressure ridges often form along tide-cracks or are heaped up by gales along the edge of the floe fields, where they are cemented by spray and by spring thaws and augmented by snowdrifts. These masses are sometimes of immense size, rising thirty or forty feet out of the water—too large to melt during the short summer. The ice conditions east of Point Barrow seem to depend largely upon the prevailing winds during the early summer. If the winds are easterly the ice masses move out to the north-westward of Point Barrow and Wrangell Island, leaving an open ocean for navigation. If the winds are westerly the great ice-pack is jammed against the northern coast of Alaska and the region about the mouth of the Mackenzie, where there is no easterly exit.

In 1913, for the first time in about twenty-five years of whaling in that region, no ship from the west was able to reach Herschel Island. It was known as "a bad ice year." Of the ships caught in the ice two were sunk. As usual when the sea is filled with great masses of ice, the temperature of the water and the air was much lower than normal, snow squalls were frequent, young ice kept forming in the spaces between the larger ice cakes, and the solid freeze-up occurred a month earlier than normally. The occasional large masses scattered among the crushed-up areas of bay ice are an advantage to vessels of small draught. The large ice cakes ground on the gradually shoaling bottom some distance off shore, and small vessels can get shelter by tying up behind them. The ice would occasionally relax its grip on the coast and move off half a mile or so with changes of tide or wind, and the vessels could creep ahead a little. The *Alaska* and *Mary Sachs* were finally obliged to give up hope of getting farther than Collinson Point, Alaska, $69^{\circ} 59' \text{ N.}$ and $144^{\circ} 50' \text{ W.}$, and decided to go into winter quarters September 10.

At Collinson Point luckily we fell heir to a large, recently abandoned log cabin, well built of driftwood logs, and driftwood fuel was abundant, as it is in most places on the coast for two or three hundred miles on either side of the Mackenzie River delta. Game was scarce, as the caribou have been nearly exterminated on the Arctic coast of Alaska, but some mountain sheep and a small amount of caribou meat were brought down by inland Eskimos.

The men of our party rapidly became used to outdoor life and travel in

the Arctic and the technique of making scientific observations at low temperatures. A snow house makes a good observatory, although at 40° below zero a light breath or even the invisible vapor from a bare, warm hand will speedily cause a film of fog or frost to form on lenses and all metal parts. Even guns are kept outside all winter, for if taken indoors they instantly become coated with heavy white frost and drip water as the metal becomes warm, causing rust inside and out if they are not taken apart and cleaned soon after.

In February O'Neill and Cox started for the international boundary (141st meridian), about 100 miles east of our winter quarters, to complete the survey from the boundary to the Mackenzie River, connecting with the survey made by the International Boundary Survey party in 1912. This spring's work and that of the next two seasons demonstrated that very little accurate topographical surveying on the lines laid down for us (ten miles to the inch, with control stations at frequent intervals) could be done before the middle of March. Some compass lines could be run before that time, where salient points were already located, but earlier in the season the sun is too near the horizon to get satisfactory observations, on account of the refraction. Blizzards and clouded skies are so frequent that calculated occultations of stars and planetary satellites rarely can be observed at a stationary observatory and are of little use in field work.

In addition to the coast survey from the international boundary, there was carried out a geological traverse up the Firth River (Herschel Island River) into the Endicott Range and a geological reconnaissance of Herschel Island.²

As soon as the Mackenzie River ice broke up, Chipman surveyed the east branch in company with O'Neill, and Cox surveyed the west branch. This survey shows the west branch to have a channel at least six feet deep through the shoals at the entrance into the deep water of the river. The east branch has a channel with about the same depth of water. The middle branch, which is supposed to be the deepest, was not surveyed because the boat parties had to join the *Alaska* at Herschel Island and go east to their main field of work. The Mackenzie furnishes an immense waterway, for boats drawing not more than six feet, southward as far as Great Slave Lake, where shoals at a depth of about five feet form a barrier at low-water stages. Otherwise there is deep water from the coast up stream as far as Fort Smith, on the 60th parallel.³

Herschel Island, Y. T., 69° 34' N., 138° 54' W., is quite a busy place in July and August. Eskimo whaleboats to the number of twenty-five or more and perhaps a dozen two-masted Mackenzie-built schooners are usually assembled here to trade with incoming ships; and in 1915, the Hudson's Bay Company established a Western Arctic district with headquarters at

² *Summary Rept. Geol. Survey of Canada for 1915*, Dept. of Mines, Ottawa, 1916, pp. 236-237.

³ *Ibid.*, pp. 237-239.



FIG. 3.—House used by Southern Party of Canadian Arctic Expedition as base from 1914 to 1916.



FIG. 4—Camp near northern limit of trees on east side of Coppermine River, near Sandstone Rapid. Trees here are thick at their bases, but rapidly taper off. Note large number of dead trees, mostly killed by bark-beetles. February 15, 1915.

Herschel Island. Other posts were founded 150 miles east of the Mackenzie at Baillie Island or Cape Bathurst, $70^{\circ} 35' \text{ N.}$, $128^{\circ} 5' \text{ W.}$, and at Kit-tigazuit (the old Point Encounter of Sir John Richardson) at the eastern edge of the Mackenzie delta, the site of one of the largest villages of the Mackenzie Eskimos. In 1916, the company moved 400 miles farther east and established a new post at the station just vacated by the Southern Party in Dolphin and Union Strait (Bernard Harbor). These new posts of the "Big Company" are supplied by a gasoline motor schooner, the *Fort McPherson*, from the large storehouses at Herschel Island stocked by chartered ships sent up from Vancouver.

The importance of the animal life of the northland of Canada has been recognized for hundreds of years, so much so that all the northern regions were long known as the "Fur Countries." Of the total amount of fur produced, the Arctic realm itself has not furnished so much as the wooded country farther south, partly because of its greater barrenness and inhospitality, which results in fewer valuable species than the timbered country produces, partly because of fewer natives, and partly because of its inaccessibility. In recent years, however, owing no doubt to greater competition among fur traders outside, the advance of trade into the north has been rapid, both by the large companies and by small independent vessels, free traders, and trappers.

In traveling over the Arctic lands, we find few regions so inaccessible or desolate that they can not support at least some natives who have been schooled by necessity to make use of meager resources. When the country is ultimately opened up, to a much greater degree than at present, and developed for its timber resources in the more southerly portions and possibly for mineral wealth farther north, the game of the country may by proper conservation become a valuable asset and the fur industry still remain of importance in vast regions which may have no other use.

The *Alaska* left her first winter quarters at Collinson Point on July 25, 1914, the first day the ice moved off shore, and, after some blocking by ice, reached Herschel Island on August 5. The *Mary Sachs* arrived a little later. These expedition vessels were the first ships to come into Canadian waters in the western Arctic flying the Canadian flag. Stefansson had started from Martin Point, Alaska, in March on an ice exploring trip. His support party had returned in April, but Stefansson and his two seamen, Storker Storkerson and Ole Andreason, had not returned. If they had returned to the mainland in the spring they would have been heard from sooner, and our knowledge of their proposed plans made it evident that they had gone on towards Banks Island. The *Mary Sachs*, with a full equipment for two years and under the command of George H. Wilkins, sailed for Banks Island August 11, and found Stefansson's party near Cape Kellett early in September.

On August 17 the *Alaska* left Herschel Island eastward bound, was

delayed by ice between the island and Shingle Point (on the west side of the Mackenzie delta), and reached Baillie Island (Cape Bathurst) on August 21. Sailing through smooth summer seas that were free of ice, we reached our goal at Bernard Harbor, Dolphin and Union Strait, $68^{\circ} 47' N.$, $114^{\circ} 50' W.$, in the evening of August 24. After the stores had been unloaded and the members of the scientific staff had disembarked, the *Alaska* returned to Herschel Island but was prevented by bad weather and ice conditions from returning farther east than Cape Bathurst in 1914.

As soon as the ice was good for travel I set out on the 400-mile trip along the coast from Cape Bathurst to join the rest of the party at Bernard Harbor. At Keats Point we met O'Neill and Chipman, who were making a preliminary reconnaissance trip along the coast, and we reached the base station together on Christmas Day, 1914. They had found the fogs and blizzards of autumn very unsatisfactory for survey work, though the temperature was scarcely ever below zero Fahrenheit even during December. When we met them they had been held in camp for six days, with strong head winds and blizzard, while we had been able to travel part of the time with fair wind, which makes a tremendous difference.

DETAILED SURVEY WORK

O'Neill and Chipman made a detailed survey of this coast in March, April, and May, 1915, filling in the blank unexplored section of Darnley Bay between Cape Parry and Cape Lyon, fixing the position of Hornaday River⁴ flowing into the south side of Darnley Bay, and going some distance up the river flowing into the southeast side of the bay. For the convenience of future travelers, we have adhered to the policy of retaining the native place names wherever these could be ascertained, but as this particular stretch of coast is uninhabited, we have proposed the name "Broek River" for the southeastern river, in honor of Major R. W. Brock of the Canadian Expeditionary Forces, recently Director of the Geological Survey, to whose active interest in northern geology the organization of the geological and topographical sections of the expedition was largely due. After a long trip up the Coppermine to the Dease River, I went west along the coast in the spring to reinforce the western survey party. At the same time Cox mapped the west end of Coronation Gulf, ascended the little-known Rae River about seventy miles to the junction of two small creeks which unite to form it, and then made an overland portage to Stapylton Bay, cutting through the middle of another large unexplored district. Large willows were found at frequent intervals on the Rae River after he had penetrated some miles from the coast, but no spruce or other timber was found. The rock exposures were the prevailing dolomite of the region, with diabase near the mouth of the river. Caribou were seen migrating northward nearly every day during the early part of May, in the Rae River region.

⁴ A. J. Stone: Some Results of a Natural History Journey, etc., *Bull. Amer. Mus. Nat. Hist.*, Vol. 13, 1900, pp. 31-62.

The country west of Coronation Gulf is mostly drift-covered, with occasional exposures of dolomite in sea cliffs and in the river valleys. There is a little conglomerate near Buchanan River, and a few dikes of diabase occur in the Darnley Bay region and for some distance east of Cape Lyon. These dolomite cliffs are also typical of southwestern Victoria Island. At Point Williams and Cape Hamilton are vertical dolomite cliffs about 125 feet high, where hundreds of gulls nest in niches in their face. Rock fossils are extremely rare, but several species of Silurian corals were found on Liston Island in Dolphin and Union Strait. Large numbers of king eiders and Pacific eiders nest on small islands on both sides of Dolphin and Union Strait, but this particular district seems to be too dry and too barren to support any kind of shore birds or land birds in large numbers.⁵

The western survey having been finished late in May, O'Neill and Cox started eastward from Bernard Harbor on June 9. The expedition had always prided itself on being thoroughly prepared and equipped to take the field and work at any season and under any conditions. These problems of equipment embraced winter and early spring sledging with tent and snow house, using either wood alcohol, Primus oil stove, or native blubber lamp; late spring travel on either ice or water; summer travel with boat or canoe; and overland packing by men and dogs in summer.

In Coronation Gulf the ice was still solid in June, but there was the possibility of cracks and leads to cross later, and boat work after the break-up. The Northern Party had made good use of waterproof tarpaulins in constructing sled rafts to cross leads, being unable to haul canoes over the rough ice. This made no provision for travel after the break-up of the ice.

We made very satisfactory provision for this kind of travel by strengthening the stern timbers of a large Point Barrow whaling umiak, 28 feet long and covered with heavy bearded-seal skins, providing for the attachment of an Evinrude motor and carrying the umiak on a low ivory-shod boat sled. In the spring, a few dogs could haul this boat with ease, carrying several hundred pounds of baggage inside, and it could be unshipped and launched in a few minutes whenever a ferry was needed. In fact, if the ice should break, the canoe would be loaded and launched automatically. Later in the season the umiak with from two to four men, three dogs, and a thousand pounds or more of guns, gear, grub, and gasoline, made from five to six miles per hour, weathering some pretty stiff seas. It could be beached on any kind of coast in a hurry, by rolling it up on inflated sealskin "pokes," a great advantage when exploring a coast whose harbors are unknown and a sudden breeze raises a dangerous lop in a very short time. The umiak is very useful among ice-floes, as it is practically impossible for it to be stove; it can easily be hauled up on an ice cake, and it will also stand bumping

⁵ *Summary Rept. Geol. Survey of Canada for 1915, Ottawa, 1916, pp. 220-239.*

over the boulders on a river bottom which might prove disastrous to a wooden boat.

The canoe party crossed Coronation Gulf direct from Cape Krusenstern to the mouth of Tree River, $67^{\circ} 46' \text{ N.}$, $111^{\circ} 59' \text{ W.}$, being delayed by but one large crack. This route leads past numerous islands, including the Duke of York Archipelago. These islands, of which the Pauneraktok group are typical, have in most cases precipitous cliffs of diabase, frequently overlying sandstones, facing the south or southeast and sloping down on the north and west sides. Part of June and all of July were spent around Port Epworth or Tree River (Kogluktualuk of the Eskimos). A little west of Tree River granite rocks begin to appear. On the south side of Coronation Gulf the granite is overlain in places with shale, limestone, or sandstone; on Gray's Bay by schist; on Bathurst Inlet by dolomite and quartzite; and throughout the whole area frequently cut by dikes and capped over large areas by sills or flows of basalt or diabase.

Tree River was explored on a packing expedition some distance inland. It is said to have one of its heads near the Coppermine, and to have spruce trees on one branch. Like all the other streams of this region (in the granite area) it has rapids, cascades, and falls a few miles from its mouth, and is full of fish in the summer time. Several families of Eskimos usually spend the summer at the first cascade, catching fish by spear and hook, and by raking with a sort of double gaff-hook. Salmon trout and whitefish are largely caught in the rivers, while large lake trout are caught in nearly every lake of any size.⁶

Chipman and I brought a small gasoline launch to Cape Barrow ($68^{\circ} 1' \text{ N.}$, $110^{\circ} 59' \text{ W.}$) on the schooner *North Star* on August 12, met the canoe party, and operated with them for the remainder of the season, surveying Moore Bay, Arctic Sound, Hood River, Barry Island, and other parts of Bathurst Inlet. Parts of this region had not been visited since Franklin in 1821, or Dease and Simpson in 1837 and 1838, and, as these explorers had only made a hurried trip with canoes and cut across many points without careful examination, we made many interesting discoveries in the intricate system of deep, narrow fiords and numerous islands in Bathurst Inlet.

Cape Barrow, or Haninnek, as it is called by the Eskimos, is a mountainous granitic region, but is not nearly so high as stated by Franklin in 1821. He says: "The higher parts attain an elevation of 1,400 and 1,500 feet and the whole is entirely destitute of vegetation."⁷ In 1915 we found the height of the highest of the granite ridges to be 340 feet above sea level by aneroid, and although the hills have a barren appearance on their summits and slopes, careful inspection shows many bright green patches in the little valleys and gullies, where soil has collected, as well as in basins in the rocks,

⁶ Summary Rept. Geol. Survey of Canada for 1915, Ottawa, 1916, pp. 240-241.

⁷ John Franklin: Narrative of a Journey to the Shores of the Polar Sea, London, 1823, p. 369; also as reprint in "Everyman's Library," p. 375.



FIG. 5.



FIG. 6.



FIG. 7.

FIG. 5—Start of survey party from Bernard Harbor, Dolphin and Union Strait, with skin umiak on boat-sled, June 9, 1915. The umiak is "bowsed up" across top to prevent breaking keel on sled. Evinrude motor, gasoline, and excess baggage carried inside canoe hauled easily by five dogs.

FIG. 6—C. G. S. *North Star* leaving the small deep harbor at Cape Barrow, Coronation Gulf. Harbor surrounded by granite rocks. Jameson Islands visible to the northward, in the background. August 12, 1915.

FIG. 7—Rock cairn, forming cross 12 feet high, erected by Dease and Simpson in 1839, on point between Port Epworth and Gray's Bay. Left to right: J. R. Cox, J. J. O'Neill, K. G. Chipman. September 30, 1915.



FIG. 8.



FIG. 9.



FIG. 10.

FIG. 8—Eskimo village of snow houses and caribou-skin tents on island near mouth of Coppermine River, Coronation Gulf, October 27, 1915. The Eskimos here have recently arrived from their annual autumn caribou hunt inland and are preparing to go out on the ice sealing later.

FIG. 9—Eskimos coming down the Kogluktualuk (Tree) River from the first rapids, where they have spent the summer fishing. This man has an extemporized sled made by lashing together green willow saplings to form a frame and building up the runners of mud and tundra muck frozen on and coated with ice.

FIG. 10—C. G. S. *Alaska*, loaded and ready to sail out, in Bernard Harbor, July 12, 1916.

around the little lakes—green grass, low dwarf willow, deep tundra moss, cotton-grass or “nigger-head” tussocks, heather growing luxuriantly on many shelving rocks, and about ten species of flowering plants in bloom close to our camp on August 13, 1915. The summits of the granite ridges in general were covered with gray lichens. In this region we were often deceived by great reddish areas on cliffs, which had the appearance of ferruginous rock, but upon closer examination proved to be only a dense coat of red lichens.

A considerable copper-bearing area was found in Bathurst Inlet and was followed up, with a view to making a detailed geological sheet of an important area rather than attempting to make a complete survey of the head of Bathurst Inlet outside the copper area. The scenery in Bathurst Inlet is most striking, cliffs of dolomite overlain by diabase rising to a height of 870 feet in the Banks Peninsula region, at Cape Wollaston, the north end of Banks Peninsula, $67^{\circ} 38' \text{ N.}$, $108^{\circ} 40' \text{ W.}$, and to over 600 feet on Barry Island. Caribou were seen at Kater Point, near Hood River, and on Kannuyuk Island, and were taken without difficulty when we needed meat. A large Barren Ground bear was killed on Arctic Sound. Two wolverines were shot and others seen, the species being surprisingly common far north of the timber line in this region.

Among the points of interest noted on the south side of Coronation Gulf west of Cape Barrow was the great length of Inman Harbor, a very deep, narrow fiord, the head of which is separated by a low portage of half a mile from another deep inlet running in from the east side of Cape Barrow, nearly making an island of the Cape Barrow peninsula. West of Cape Barrow there are three fairly large rivers flowing into Gray's Bay. The eastern is called Utkusikaluk (charted at its mouth by Sir John Franklin in 1821 and by him named the Wentzell River), the middle and apparently the largest river is called Kogluktuaryuk, and the western, Annielik (incorrectly indicated on Hanbury's map⁸ as the Unialik). Tree River, or Kogluktualuk, flows into a fine large bay called Port Epworth, about 65 miles east of the Coppermine; about 25 miles west of Tree River is the big Kogaryuak, and about 18 miles from the Coppermine River is a smaller stream also called Kogaryuak by the natives. All of these rivers have falls or rapids a very few miles from the coast.

We got our two boats back to Tree River just before the freeze-up, which occurred on October 5. Sleds had been cached there, and the surplus dogs had been left at the fishing-place for the summer with some local Eskimos. Dried fish had been cached here in the summer, fat caribou meat was obtained in the fall, and, by frequently dropping a net for fish, shooting caribou, Arctic hares, and other game when needed during the summer, we had been enabled to keep a large stock of reserve provisions and had no hardship in waiting at Tree River for about three weeks, until the ice of

⁸ D. T. Hanbury: *Sport and Travel in the Northland of Canada*, London, 1904.

Coronation Gulf became strong enough for us to start for home on October 27 without following all the indentations of the coast. We reached Bernard Harbor station with our sleds November 9, 1915, and received the first news of the loss of our friends on the *Karluk* and of the European War, when it had been raging for over fifteen months.

MIGRATION OF THE CARIBOU

An interesting and important feature of the Coronation Gulf region is the migration of the Barren Ground caribou from the mainland northward to Victoria Island in April and May, and a southward migration as soon as the ice is strong enough for crossing again in November. The exact crossing place of the larger herds seems to vary from year to year. Thus, in 1914, the straits froze over very late and the caribou from the north bunched up on the south shore of Victoria Island. Being unable to cross they slowly drifted eastward along the coast and crossed Coronation Gulf mainly east of Cape Krusenstern. In 1915 they crossed in large numbers at Bernard Harbor around the middle of November, and in a few days we stowed away forty-five prime carcasses for our winter meat supply. Cold storage is simple. By merely keeping it under cover, meat remains frozen until June. Very few caribou are found around Dolphin and Union Strait coast in winter, although a few stragglers have been seen. In three different years I have found them in fair numbers near the coast around the mouth of the Coppermine River.

ARCTIC TIMBER AREAS

The northern limit of spruce trees on the Coppermine River is about 20 miles from the coast, although some stragglers are found growing five to ten miles from the coast on Naparktokuok Creek, a few miles east of the river. Willows of good size, and from ten to fifteen feet high, are found in many places north of the tree line, and persist until they dwindle to small ground-creeping shrubs on the northern islands and wind-swept mainland coast.

To the west there are no trees anywhere near the coast until we come to Franklin Bay, where we find spruce of fair size ten or fifteen miles inland in the valley of Horton River. Spruce comes rather close to the coast on the Anderson River south of Liverpool Bay. Still farther west we find the great northward extension of timber in the Mackenzie delta, fair-sized trees occurring northward nearly to Richard Island about 150 miles north of the Arctic Circle.

On the Horton River, the Coppermine River, around Dismal Lake, and to a less extent farther west, we often noted the large proportion (in some places 90 per cent) of dead spruce trees near the northern limit of timber. There seemed little evidence of fire destruction, and the explanation that the northern regions are becoming colder and the vegetation retreating

seemed inconclusive. On one of our winter trips Mr. Johansen accompanied a sledge party southward to the timber line on the Coppermine River and made a careful study of conditions. He found that practically all the dead trees showed traces of the ravages of bark beetles, three species of them being found.

SURVEY OF THE UNEXPLORED CROKER RIVER

After returning from the Coppermine River trip, Mr. Chipman and myself made a survey for some distance up the Croker River, the largest river flowing into Amundsen Gulf, between Darnley Bay and Coronation Gulf. The mouth of the river is indicated on Franklin's and Richardson's maps, about fifteen miles west of Clifton Point ($69^{\circ} 13' \text{ N.}$, $118^{\circ} 40' \text{ W.}$), and Richardson mentions the size of its delta. The river itself was of particular interest to us because it promised to give an important geological section into the heart of the Barren Grounds halfway between O'Neill's reconnaissance in from Darnley Bay and Cox's traverse from Rae River to Stapylton Bay, the whole intervening country inland having been hitherto a *terra incognita*.

The apparent size of the river at the coast, where it spreads out into a triangular delta about five miles on each side, is larger than the actual volume of the river bears out, for, before emerging from its dolomite box-canyon about five miles from the coast, the river averages only about sixty yards in width. It probably carries considerable water for a short time, as the snow melts very rapidly on the Barren Grounds in spring and the ice breaks up early.

The deep and strikingly picturesque canyon of Croker River was unsuspected, as the surrounding country is rather gently rolling and one could come within a mile of the gorge without seeing any sign of it. We found that the river had cut a vertical-walled canyon through yellow dolomite rock for over twenty miles, averaging three hundred feet in depth for most of the distance, with no way out of the gorge at the sides for miles. Remarkable pillars and castellated rock effects were frequent.

Heavy snowdrifts (due to the prevailing winds) overhung the west bank of the river in immense cornices in many places, and there had been great avalanches here and there that made barrier ridges of hard, icelike, angular-fractured snow blocks extending most of the way, and sometimes all the way, across the river. The river continually makes short, sharp bends, but its general course is northerly. It finally became so obstructed by avalanche barricades that we could scarcely take a loaded sled over them and were obliged to cache most of our load. Farther up the river seemed to have quite a steep descent, with some rapids, if not waterfalls. The snowdrifts and ice barriers were so deep, however, in most places that it was impossible to see the character of the river bed. In some stretches of the river progress was only made by climbing over one rugged hill of fallen



FIG. 11.



FIG. 12.



FIG. 13.



FIG. 14.



FIG. 15.



FIG. 16.

FIG. 11—Eskimo women cooking with heather on Barren Grounds in shelter of a caribou skin hung up for a windbreak. Fishing Lake, near Bernard Harbor, July 3, 1915. Fish are to be seen drying on poles laid across stones.

FIG. 12—Young man, Umingmuktogmiut, in hunting costume, with quiver on his back. Cape Barrow, May 21, 1916.

FIG. 13—Ice, boulders, gravel, and driftwood pushed up on tundra by heavy summer gale. Camden Bay, Alaska, east of Collinson Point, July 3, 1914.

FIG. 14—Cape Bathurst (Baillie Island), the most northerly trading post in Canada. July 26, 1916.

FIG. 15—Dolomite cliff, capped by diabase, Adligak Island, east of Barry Island, September 10, 1916.

FIG. 16—Cliff of diabase, overlying red quartzite, south side of Barry Island, Bathurst Inlet, September 6, 1915. There was a large glaucous gull rookery on this cliff.

snow blocks, descending twenty or thirty feet into a deep pit, and immediately ascending another ridge. It was much like working through very bad pressure-ridge sea ice. Frequently we had to boost and lift the sled up over ridges by main strength and take the dogs out of harness to let the sled down. The rock strata are horizontal in most places, with some slight local variations of not more than four or five degrees. Quartz geodes, with brown and transparent crystals of topaz, were numerous in the walls of the canyon. The tops of the surrounding hills are covered with small stones, little angular fragments of dolomite, and a few boulders of granite and diabase. The ground is barren. The only signs of life seen on the whole river trip were an Arctic fox track near Mount Davy, a few Arctic hare tracks, and one hare which we killed. One raven was seen near the mouth of the river. The coldest weather of the winter was recorded while we were up Croker River, 46° below zero Fahrenheit, at 6 A. M., March 31. The thermometer rose to 9° below zero at 4.30 P. M. the same day.

We climbed Mount Davy, the most conspicuous landmark of this whole region. Its top is about 2,000 feet above sea level, the mountain itself being only a hemispherical mound of gravel rising about 200 feet above the general level of the gradually rising coastal plain. The so-called range of mountains extending from the Melville Mountains south of Langton Bay and following the coast from Darnley Bay east seems to be entirely composed of this type of rugged drift-covered hills.

OLD BEACH TERRACES OF AMUNDSEN GULF AND DOLPHIN AND UNION STRAIT

The year before, on the east side of Darnley Bay, beach gravels and terraces were found above 500 feet, and everywhere east of that point the country for some distance from the coast is of the same type. The coast has a well-defined shore line of rock or boulders and gravel. West of Chantry Island (off Bernard Harbor) there are well-preserved beach terraces up to over 45 feet above high water, and numbers of fossil shells, similar to those on the present strand line, were collected at different levels. Near the mouth of Inman River numbers of shells were collected about 170 feet above the present sea level.

The coast line from Cape Lyon eastward was found to be somewhat straighter than the former charts give it, but this difference is due to the impossibility of sketching a coast line accurately from a boat passing some distance off shore. Many of the so-called points on the map of this coast are not salient projections. The named points are more often high land or rock cliffs with low land on either side of them, giving the higher places the appearance of points or capes when viewed from a distance. The method adopted by Mr. Chipman of locating control points at frequent intervals by latitude, longitude, and azimuth observations, and traversing between these points by frequent compass sights and pacing all of the intervening shore lines will undoubtedly give a more accurate map, although the



FIG. 17.



FIG. 18.



FIG. 19.



FIG. 20.

FIG. 17—Eskimo cache at Point Wollaston, Banks Peninsula, Bathurst Inlet. Placed on pinnacle rock to protect it from predatory animals. August 29, 1916.

FIG. 18—Young man, Umingmuktogmiut, at Cape Barrow, with quiver on his back. May 21, 1916.

FIG. 19—Pillar of diabase, Barry Island, Bathurst Inlet. September 7, 1916.

FIG. 20—J. R. Cox taking time-sights at Alaska-Yukon Boundary Monument (141st meridian), August 4, 1916.

former maps of this section of the coast are really very good considering the conditions under which they were made. No serious rectification was necessary until we came to Stapyhton Bay and eastward of that point.

The survey parties began work again in the Bathurst Inlet region in March, 1916, and completed their work as planned, in May. At the same time the survey of the south coast of Coronation Gulf was finished. This completed a survey of the coast from the head of Darnley Bay near Cape Parry ($70^{\circ} 4' N.$, $123^{\circ} 37' W.$) to a point well up in Bathurst Inlet, including many adjacent islands, all on the scale of ten miles to the inch. About two hundred islands were carefully surveyed in the region originally roughly charted as Lewes, Marcet, and Chapman Islands in Bathurst Inlet. These islands are steep and rocky, and they overlap in such a manner as to appear continuous when viewed from a distance.

THE BATHURST INLET COPPER AREA⁹

The most important result of the geological investigations by O'Neill was the detailed mapping and estimation of the available copper-bearing rock in a great new area hitherto very slightly known in the Bathurst Inlet region. Copper-bearing rocks occur on most of the islands west of a line running northwest-southeast from Lewes Island and north of Kannuyuk (meaning Copper) Island. They cover most of Banks Peninsula (Tikera-yuk, the forefinger) and the western mainland shore from the mouth of Hood River to Moore Bay, extending as much as five or six miles inland from the coast. These rocks are amygdaloidal and form several successive layers which represent progressive, intermittent effusions of lava. Nearly all of these are impregnated over wide areas with native copper, occurring in veins and amygdules, and peppered through the ground mass. An estimate by O'Neill, of the copper-bearing rock, in which copper was actually seen, puts two billion tons well within the limit. As far as analyzed, the ore is of low grade, but further prospecting may locate veins and areas rich enough to render mining operations profitable. It is certainly a great reserve of copper ore. Galena was also observed, and other minerals doubtless occur. Isolated nuggets of float copper of considerable size were found; one in our collection weighed about forty pounds.

Some time in the future, possibly soon, these mineral areas will be utilized. They are remote at present and need transportation facilities, but are not much farther north than paying properties in Alaska, and in Norway, and are much farther south than the working mines of Spitzbergen. The climate is not too bad; there is a summer of about four months, and the snowfall is light in winter. Water transportation around Alaska would be rather long and uncertain, but, barring certain shoals on Bear River, there is good water transportation to the east end of Great Bear Lake, which

⁹ *Summary Rept. Geol. Survey of Canada for 1916, Ottawa, 1917.*

is not far from the Coppermine area. Bathurst Inlet is a little farther, but short railroad lines could be run without serious obstacles. The winter temperature on the coast averages considerably warmer than at most points in the interior.

ETHNOLOGICAL WORK OF THE EXPEDITION: THE COPPER ESKIMOS

The ethnologist of the expedition, Mr. D. Jenness, crossed with a band of Eskimos to Victoria Island in the middle of April, as they followed the migrating caribou, and spent the whole summer and autumn of 1915 wandering alone with them after caribou and fish. The journey was somewhat unpleasant, as much of the time they were without fuel for either cooking or heating, but his experiences are interesting and he obtained a good understanding of their language, habits, folklore, and viewpoints on life in general. During the winter he supplemented this with intensive studies of the village snow-house life, and made many gramophone records of songs, shamanistic performances, and the like. Mr. Jenness was not able to return to the station until November 9, 1915, when the ice became strong enough to cross Dolphin and Union Strait to the mainland.

There is a permanently uninhabited strip of coast 300 to 400 miles long, from Cape Bathurst, the easternmost village of the so-called Western Eskimo, to Cape Bexley, the western limit of the Copper Eskimos. I shall not go into detail in describing the Copper Eskimos, since an article on that subject by Jenness has already appeared in the August number of the *Review*.¹⁰

While hunting caribou for clothing-skins in late summer and early autumn, the Copper Eskimos live largely on their flesh and frequently dry a quantity of meat, but this dry meat seldom does more than tide them over until the ice sealing commences. In the pursuit of the caribou they often go far inland, to Dismal Lake, Dease River, and other places too far to bring food back, as all summer inland transportation must be by back-packing, by both people and dogs.

As soon as the sea ice is frozen hard and the snow packed well enough for house-building, usually in November or early in December, all move out on the ice, build snow houses, and live until spring almost exclusively on seals, which are caught by spearing at the seals' breathing holes. The seal's flesh is eaten, and a large part of the blubber is used in stone lamps primarily for cooking, and incidentally for warming the snow houses. In spring much blubber is stored in sealskin "pokes" for fall use. Even in winter meat is usually eaten cooked.

As the sun grows warmer, snow walls, roofed with skins, are used for shelter, and during the summer the people live in caribou-skin tents, some of which are little A-shaped structures, while others are large and constructed like an Indian lodge or tepee. In summer driftwood chips are burned on

¹⁰ *Geogr. Rev.*, Vol. 4, 1917, pp. 81-91.

the coast, while inland tiny shrubs, dwarf willow, dwarf birch, heather, or other woody plants are used, so that no difficulty is experienced in living on the Barren Grounds in that season. Fire is kindled by striking sparks from two lumps of iron pyrites, the use of flint and steel being apparently unknown. Rarely is fire produced by friction with a bow-drill.

After the seals come up on the ice in the spring—the harvest time for blubber among the Western Eskimos—the Copper Eskimos must quit sealing on the ice and come ashore. Early in the spring they fish extensively through the ice or along the shores of lakes, jigging with large hooks



FIG. 21—*Dryas octopetala*, a common Arctic flower, with white calyx and yellow center, on Arctic coast of Dolphin and Union Strait, at Bernard Harbor. July 3, 1916.

formerly crudely hammered out of native copper. At this season they also shoot or snare a good many Arctic ground squirrels (Parry's spermophile), making use of both the flesh and the skins. Rock ptarmigan are also killed in some numbers with bows and arrows. Later, when the fish begin to run up stream from the sea; or down stream from the lakes, the Eskimos spear salmon trout in the rapids, or impound them in stone weirs. The use of fish nets was unknown to them until about five years ago, and only a very few have yet obtained nets.

Fish are abundant almost everywhere. Large salmon trout or Dolly Varden trout run up the streams in great numbers, whitefish are numerous on the coast, big lake trout in almost every fresh-water lake of any size, while tomcod or frost-fish can be jigged in great numbers at certain spots.

Northern fish as a rule are of excellent quality, since fatness and firmness of flesh are characteristic.

Their improved methods of hunting large game with modern fire-arms will be only a very slight temporary advantage to the natives, as the law of diminishing returns soon begins to operate, and undoubtedly spells extinction for some species. The depletion of the musk ox is going on rapidly. It is already practically extinct west of Tree River. The rate of slaughter of caribou is likewise increasing. The desire of the natives for white man's goods is developing, and to trap furs to satisfy these demands the people must spend more time on land. Armed with rifles, they show a tendency to follow the line of least resistance and kill whatever game happens to be easiest to secure from day to day. Consequently a great many of the Copper Eskimos, who were normally seal-hunters from December until late in May, are now coming ashore one or two months earlier than was their former custom and living on the caribou which are migrating steadily northward at that season—mostly cows going north to rear their fawns on Victoria Island.

It is a difficult matter to do much for the protection of the musk ox, as the natives of these remote regions are practically beyond the jurisdiction of game laws and regulations. But although the savages are bound to kill a certain number on their own initiative and to supply their own necessities, they should not be encouraged and abetted in the slaughter by traders who have only a temporary interest in the country and will leave the natives to their own devices again as soon as the bulk of the fur-bearing animals have been destroyed. The same may be said for the caribou. With reasonable precautions immense herds can be conserved for future use. This would seem to be much easier and more economical than first exterminating the caribou and afterwards having to introduce reindeer to feed and clothe the natives, as was done in western Alaska. The reindeer, however, have a great field of usefulness where the caribou have been killed off.

CONCLUSION

The Southern Party of the Canadian Arctic Expedition entered upon the summer of 1916 with most of their originally outlined work completed. Many cases of specimens in all branches of science—geology, zoölogy, botany, ethnology, archeology—all had to be packed and compressed into one small 65-foot schooner. In addition to our specimens, the boat had to carry a stock of reserve provisions large enough to see us safely out of the Arctic, and it had to take twenty-seven people to Herschel Island, including our civilized Eskimo employes and two officers of the Royal North West Mounted Police who were taking two Eskimos out for homicide, the first advent of the law into the region east of Cape Bathurst.¹¹

¹¹ *Rept. of the North-West Mounted Police for 1916, Ottawa, 1917.*



FIG. 22.



FIG. 23.

FIG. 22—Eskimo spring dwelling. After the sun begins to melt the roofs of snow houses, the Eskimos use caribou-skin roofs supported on poles, retaining the snow walls until some time later in the season. This house is higher inside than it appears to be, because the floor is excavated a foot or two into the snowbank. Bernard Harbor, April 20, 1916.

FIG. 23—Dolomite cliffs in canyon of Croker River, eight or ten miles from mouth of the river. March 18, 1916.



FIG. 24.



FIG. 25.

FIG. 24—Castellated dolomite cliffs in canyon of Croker River, six or eight miles from mouth of the river. Expedition sled barely discernible at foot of cliff. First exploration of this river, March 18, 1916.

FIG. 25—Rough ice on Coppermine River between Melville Creek and Muskox Rapid, March 31, 1915. Ice is jammed high up on the boulder banks on both sides of river and all the way across for miles.

We were well loaded down when we left Bernard Harbor on the evening of July 13, 1916. We made a quick and easy voyage out: Baillie Island, July 24; Herschel Island, July 28; Point Barrow, August 8; and Nome, August 15. Our weather-beaten schooner was left at Nome to be sold, while men and specimens went on to Seattle and Victoria through the famous Alaska and British Columbia Inside Passage. Everything ultimately reached Ottawa safely, and the scientific men of the expedition have spent the winter of 1916-1917 working up their reports. Maps have been computed and plotted, mineral analyses made, plants and animals are being identified and new species described. Some of the collections represent specimens of groups which have never been collected anywhere in the western Arctic area, and practically all of them are from districts and localities which are unrepresented in collections anywhere and from regions never before visited by a collector.

ACROSS THE BOLIVIAN HIGHLANDS FROM COCHABAMBA TO THE CHAPARÉ

By LEO E. MILLER

American Museum of Natural History

Leaving the enterprising city of Cochabamba on the afternoon of May 9, 1915, we rode eastward fifteen miles on the first part of our journey to the Amazon Basin, arriving at the town of Sacaba by nightfall. The intervening country is thickly settled, and large areas are irrigated and planted in alfalfa, maize, wheat, grapes, and vegetables. Nearly all the inhabitants are Quechua Indians. Numerous little canals carry water from a brook along the adjacent mountain side, and the country is dotted with small stone huts surrounded by carefully cultivated fields. The rivulet never dries, but on the contrary supplies a constant stream of water of sufficient volume to irrigate a large area. The canals have been dug with great precision; each family uses only as much water as is required, and at stated intervals, so that there is enough for all. The trail goes up steadily until an elevation of 12,000 feet is reached. As we neared the summit of the ridge, a strong wind sprang up so that it was difficult to keep one's place in the saddle.

Beyond the first ridge lies the high mountain valley in which is located the Quechua village of Cuchicancha ("pig-pen"). There are several score of huts scattered about in little groups, built of stone and having thatched roofs. The Indians speak practically no Spanish and live in much the same way as they did in the days of Atahualpa. In order to cultivate the land they have gathered the stones, which everywhere cover the ground, into huge piles, and have also built fences of them; large quantities of potatoes, okas, and avas are grown. Each family owns a flock of sheep, which apparently replaces the llama of olden days, although herds of the latter animal are still frequently to be seen; they also keep a few pigs and burros and have taken to cultivating wheat, oats, and rye.

The Indians were friendly and brought us eggs, goats' milk, chickens, and bread. Each morning the children took the flocks to the narrow river bed to feed on the sparse vegetation, and at night they brought them back to the stone corrals; they carried a few boiled potatoes with them for luncheon and also their spinning for pastime. All spin except the men; and everyone had an abundance of blankets and ponchos; even the bags for grain and potatoes are made of home-spun wool. The harvest had been gathered and everyone seemed contented. One day a party of Indians collected to thresh wheat; from a distance I could hear the boom of a drum and the shrill wail of reed flutes; as I approached, a strange sight met my

eyes. Bundles of grain had been built into a high mound on the top of which sat the musicians; a dozen mounted Indians were driving a herd of mules and burros around the base. Round and round they went at a frantic pace, keeping perfect time with the music; as the animals circled the stack, a man on top cast armfuls of wheat down in their path, so that in running over it repeatedly they naturally trampled out the grain. About a hundred men, holding on to a long rope, formed a circular fence around the racing mob and prevented any of the animals from escaping. This was their method of threshing.

We were surprised at the abundance of life in this naturally barren region. There were practically no indigenous trees, but a long line of willows had been planted near one of the houses, and to these thousands of cowbirds, pigeons, and finches came every night to sleep. A short walk across the stubble fields always revealed something new. There were tinamous which rose with a loud whirl that reminded one of partridges; many species of brownish birds belonging to the wood-hewer family, one of them with a long, curved bill, but running about on the ground or perched on the stone fences; large flickers lived among the rocks, and condors soared above; even flocks of gulls and plovers made this barren highland their home. The most unusual birds were two species of very small parrakeets which clambered over the rocks and slept in holes in the high banks. Vast numbers of cavies lived in the rock piles, from which they sallied at all hours of the day in quest of food; and many small rodents inhabited the grain fields.

A good trail leads eastward from Cuchicancha; the summit of the range rises about two leagues from the settlement. At the time of our visit the black, rocky peaks were covered with a mantle of snow, and an icy wind swept through the cleft which serves as a pass. The elevation of the trail is 13,400 feet. At the base of the towering masses which rise several hundred feet above the passage lies a placid little lake, and ducks and gulls were swimming on its peaceful surface. Condors swept down from above to inspect us, and then soared back to their perches among the unscalable crags. On the eastern side of the divide the trail leads downward abruptly, and the character of the country changes; at 11,000 feet a sparse growth of bushes appears, growing denser with each passing mile. Suddenly we found ourselves on the rim of a gorge through which the Incachaca River rushes—a raging mountain torrent fed by melting snows. The path was a mere shelf cut in the face of the cliff; to the left rose the smooth walls of black, frowning rock; to the right was a sheer drop to the river. We could peer over the edge of the precipice and, looking down two thousand feet, see drifting clouds that filled the chasm and shut from view the bottom hundreds of feet below.

At 7,700 feet the forest begins; a collection of half a dozen huts, called Incachaca, nestles in its inner border, and there we decided to remain for a



FIG. 1.



FIG. 2.

FIG. 1—Bringing the flocks home just before sundown, in the beautiful country near Cochabamba.
FIG. 2—Quechua Indians threshing wheat at Cuchicancha.

few weeks. We secured quarters in a large house belonging to a company engaged in digging a canal on the opposite side of the gorge; when this work is completed the water of the river will be turned into the canal and used to furnish electricity for the light and street car service of Cochabamba. A power house had been constructed at the bottom of the ravine, and cables for transmitting the current were strung across the mountains. At Incahaca the river flows through an underground channel; while exploring the forest one day we came suddenly upon a narrow cleft in the mountain side, scarcely a dozen feet across, and with a great deal of effort were finally able to distinguish the roaring, white torrent a hundred feet below. The edges of the cleft are so overgrown with ferns that one has no idea of its existence until the very brink is reached. A short distance below, the river emerges from the darkened caverns, and, plunging over the face of a precipice, thunders into a pool in a sheer drop of fifty or sixty feet.

We found the upper limit of a subtropical fauna at Incahaca. Bird flocks traveled hurriedly through the trees; they were composed of bright-colored tanagers, finches, and cotingas. Honey-creepers and hummers were plentiful in the flowering shrubs. Queer little ducks (*Merganetta*) disported in the pool below the falls, and dippers ran nimbly along the edge of the water. In one of the tall trees near the river we discovered the nest of an eagle. We found it impossible to climb the tree, but a German named Ricardo Marquardt, who was in charge of the workmen along the river, succeeded in reaching the huge mass of sticks seventy feet above the ground and brought down a beautifully spotted egg. To my companion, Mr. Howarth S. Boyle, who accompanied me on the entire trip, belongs the credit of taking the rarest birds from this locality; they were a pair of white-eared thrushes (*Entomodestes*), specimens of which, so far as I can learn, are found in only two other museums. In the lower growth lived many ant-thrushes (*Grallaria*), whose clear call could be heard at all hours of the day. This is one of the hardest of all birds to collect. The long-legged, tailless songsters never leave the thick growth of ferns and brush, and the only way to secure them is to enter the dense cover, sit quietly, and imitate the clear, ringing call in the hope of attracting one of them; sometimes this requires hours of patient work, and more often than not the effort is futile. Coatimondis, or raccoons, roamed in the woods in small bands, sniffing in the damp mould and searching for insects; while feeding they uttered deep grunts, but when frightened they gave a succession of rapid birdlike chirps. These animals spend a good deal of their time in the trees, but are almost invariably found on the ground in the day time; when pursued they are very pugnacious, and it takes an exceptionally agile dog indeed to avoid being severely torn by their sharp teeth and claws. In captivity they become very tame, although their mischievous disposition often gets them into trouble.

From Incahaca to Locotal is a distance of only eight miles; and the

scenery along a part of the route is magnificent. The bare, shattered, and split crags reach many hundred feet above the trail, and some even stand in a leaning position so that the tops actually hang over the narrow passageway as if threatening to topple down at any moment; below, the steep slope is covered with huge boulders which have fallen from the towering masses above. At Locotal there are but half a dozen houses, occupied by Quechua families who subsist mainly on the profits derived from the sale of *chicha*. We stopped a few days in a hut owned by a kind-hearted old woman who gave us permission to use it; next day we found that we were occupying the school-room, and the teacher, followed by his half dozen ragged scholars, came to take possession, but he declared a vacation until the *gringos* should move on.

The forest at Locotal is somewhat taller than at Incachaca, but the birds are of a similar character. Very abundant and beautiful were the brilliant cocks-of-the-rock; the bright, orange-red creatures flashed through the deep green of the forest like fiery comets and, perching on the low branch of a tree, quietly surveyed their surroundings or uttered hoarse, croaking calls. This bird is most conspicuous in its natural environment. Among the other large birds were green toucans (*Aulacorhynchus*), which the natives hunted on every possible occasion for the sake of obtaining the bill. This they use as *remedio*, the rasping sound made by rubbing the mandibles together being supposed to be a sure cure for epilepsy.

While we were pursuing our work at Locotal, a man named Quiroga chanced to pass and begged that we pay him the honor of stopping at his house some distance below; it was a charming place, he said, in the very heart of the wonderful *yungas*. We gladly accepted his invitation and one morning loaded our outfit on mules and started down the trail. For a mile there is only a narrow ledge in the face of a rounded mountain of dark sandstone; a few stunted sprouts and myriads of orchids covered with purple blooms have secured a precarious foothold in crevices in the glazed surface; hundreds of feet below, but invisible, the river tears through a narrow gorge.

Miguelito is only three miles below Locotal and consists of three or four huts in the center of a grassy clearing. The Quechuas who live there are friendly, and one may be sure of a welcome for a night's stop. At 5,500 feet the forest becomes taller and the trees attain a greater diameter. The vegetation of the subtropic zone reaches its highest development at this altitude. After crossing a ridge 6,700 feet high, the trail descends a long slope into the *yungas*, properly known as the *yungas* of Cochabamba. At the base of the ridge, and shortly before entering the cultivated area, we crossed the dry, narrow bed of a stream which was filled with rocks bearing the imprints of leaves, and also fossil shells.

Yungas is the name given to the fertile mountain slopes which have been cleared of forest and cultivated. When we visited the region, in June, only



FIG. 3—Pass at Cuchicancha.



FIG. 4—Tightening the packs at the base of the pass, beyond Cuchicancha.

the Indian caretakers lived in the habitations, the coca, which is the principal product, having been collected a short time before and the *propietarios* having gone back to Cochabamba. The owners visit their plantations three times a year, supervise the gathering and packing of the leaves and, after a month, return to Cochabamba to sell the drug and live on the proceeds until the next harvest.

After spending an hour in questioning the occupants of the various houses that we passed, we succeeded in locating the hut to which we had been invited. It was a low, one-room, board structure, open at both ends and having wide entrances on each side, situated in the center of a large banana field. An Indian, so old that he could hardly walk, lived in the hovel and refused to admit us; however, we flourished our letter of introduction from the owner of the premises, took possession without very much trouble, and remained a week. The climate at this season, June, is most trying. Although the elevation is only 3,500 feet, the whole region was covered with fog every night, and the cold and damp penetrated everything; during a part of the year the weather is good, and then life in the *yungas* is more tolerable.

The fauna of the country seems to represent a transition zone. There are birds typical of the higher country, and others which are common lower down; also, a number found at approximately this altitude only. Near the house, and on the edge of the banana plantation, was a tall, isolated tree. Flocks of birds in their flight from one side of the canyon to the other would invariably alight in its branches for a few minutes. There were many brilliantly colored little tanagers (*Tanagra*) which came to the tree in considerable numbers and chirped and quarreled as they flitted about examining the leaves for insects, or reached out to pick the small fruits with which the tree was covered; one day not less than seven species of these birds visited this resort within a short time. Giant orioles (*Ostinops*) were also very plentiful, and traveled in large, noisy flocks. One of the more interesting birds was a species of small, red-tailed parrakeet (*Pyrhura*) which clung to and crawled up the sides of trees like wood-hewers; it was almost impossible to see them unless they moved, so well did their coloration conceal them.

There is no flat valley along the river, which is of considerable size, and all cultivation is done on the steep mountain sides. Coca is planted in terraces and occupies the greatest acreage; there are also red bananas, plantains, guavas, and sugar cane. Numerous huts of flimsy construction are scattered along the entire twenty miles or more of cultivated slopes; each has a fenced-in area paved with flat stones upon which coca leaves are dried. We stopped at a number of these dwellings in an attempt to buy fruit or vegetables, but unfortunately the men were all away working in the fields, and anyone who has attempted to purchase anything from the average Quechua squaw knows how hopeless a task it is. Although they may have a super-

abundance of the article desired, they seem to take great delight in refusing to sell anything to a stranger. In such cases the only method to follow is to take what is needed, pay a fair price for it, and pass on, leaving them in the midst of their wild rantings. The men are easier to deal with. The peons, and the patron as well, stopped at each hut where the white flag announced that *chicha* was for sale, and attempted to drink enough to last them until the return; after their money gave out they left articles of clothing in payment for the drinks. It was therefore a great relief when the last abode of the intoxicating beverage had been left behind, and we plunged into the wilder-



FIG. 5—Town and valley of Cuchicancha in the Eastern Andes of Bolivia.

ness. Immediately after leaving the *yungas* we ascended a precipitous slope, the top of which was 700 feet above the surrounding country; and then descended on the other side until the elevation was only 2,000 feet; here the forest was more tropical in character, and some of the trees, especially the cottonwoods, reached a height of 150 feet and measured 25 feet through the buttressed roots at the base.

The day after leaving the *yungas* we reached the most dangerous part of the whole trail. After crossing a number of steep, high ridges, we came to an abrupt slope seared by a huge gash where the treacherous white clay slides constantly into the river, many hundreds of feet below. Each caravan desiring to pass must first cut a ledge in the moving mass of soft, muddy earth, and then hurriedly lead the mules across, one at a time, before

the newly-made trail is obliterated. The spot is very appropriately named *Sal si Puedes* (pass if you can).

That night we made camp early on the banks of the Rio San Antonio, called "Chuspipaseana" by the Indians, which means Mosquito River. The altitude of the site is only 1,800 feet above sea level. The river was a clear, rapid stream one hundred feet wide, flowing through a rock bed a quarter of a mile across. Swarms of black flies, sand-flies, and other stinging or biting insects immediately came out to greet us. Birds were very abundant. In addition to the jays, ant-wrens, and manakins which remained in the forest, flocks of parrots and toucans flew across the open spaces. An unusual occurrence was the great flocks of a new species of giant oriole; there were not less than a thousand of these birds in a single flock, and they roamed almost everywhere, coming close to camp to inspect the tents and to discuss them in hoarse cries of curiosity or resentment. They were beautiful creatures, of a deep chestnut color with light olive-green head and neck; the face is devoid of plumage and is flesh-colored, while the tip of the bill is deep orange. The flesh is highly esteemed by the natives. As soon as the cargoes were neatly placed in a pile and covered with a tarpaulin to keep them dry, the peons cooked their supper; this consisted of a thick soup made of corn meal and *charque* (dried beef). They had a meal in the morning and another at night; during the long walk throughout the day they chewed coca leaves. The mules were turned loose to shift for themselves, but, as plenty of wild cane grows near the rivers, they had an abundance of food.

The remainder of the journey was through the heavily forested lowland; the last of the mountain ridges had been left behind. During the dry season caravans follow the courses of streams as much as possible. The water is low and the wide, rocky margins serve as roads. This is far from being easy on the mules; the animals go stumbling and slipping along, but a good many miles are cut from the total length of the journey. Streams are encountered with frequency and as one penetrates farther into the interior they become wider and deeper. We crossed not less than six fords in a single day, all between two hundred and three hundred feet wide, the water averaging from three to four feet deep. Although the current is strong, the mules are accustomed to this kind of work and usually manage to cross safely, often stopping unconcernedly in the deepest, swiftest spot to take a drink. Occasionally, however, one of the animals slips on a moss-covered boulder and falls; then it is a difficult matter to assist the drowning creature to his feet, as the swift water may roll him over and the weight of the pack keep him down.

Wild animals are particularly abundant in this section of the country. All day long we could hear the raucous scream of long-tailed, multi-colored macaws (*Ara*) as they flew two by two overhead. Many hawks sat alert on dead snags near the water, and black and white gulls flapped silently

up and down the river. Occasionally we caught a glimpse of a small flock of muscovies, the largest of South American ducks, as the great, black birds flew heavily upstream. There were also guans, resembling small turkeys, which sat quietly in the tops of tall trees until we approached quite near to them; then, emitting a loud, mulelike bray, they set their wings and soared across the river or down into the underbrush. At night the forest was usually quiet, reminding one of "Pools of Silence." Occasionally, however, the still air was suddenly rent by the most unearthly noise that mortal man ever heard, and the woods rang with the wild, insane cackle of forest rails (*Aramides*). Beginning with a shrill *oohoo-hee-cra* the demoniacal chorus would continue several minutes without interruption, finally ending with a few low, explosive *cow-cow-cows*. A number of birds always sang together, and the first time one hears the performance it is enough to make the flesh creep and the hair stand on end; and even after one becomes somewhat accustomed to the noise it fails to be conducive to peaceful slumber. Night monkeys (*Douroucoulis*) were apparently plentiful, but we never saw them in the daytime. After darkness had fallen they began to move about in the tree-tops; on one occasion a troop selected the tree under which we camped for the scene of their frolic, and kept us awake the greater part of the night. They dropped leaves and twigs down upon the tent-fly, probably through accident, but perhaps prompted by the desire to find out if anything would happen. At frequent intervals they drew together in a close group to chatter in low, grunting tones, and then, apparently coming to the conclusion that the queer-looking objects below them must be capable of some interesting action, again tempted fate by showering down more twigs and leaves.

In many places the receding water of the river had left isolated pools; these were teeming with fish of many species, some of which were of large size; a number we caught had practically the entire tails and fins eaten off, their cannibalistic brethren having no doubt taken advantage of the circumstances and begun to devour them piecemeal at their leisure. The trees were tall and straight, and there was dense undergrowth near the rivers only. Mosses and epiphytes, so typical of the subtropical zone, were almost lacking; but frequently the wind brought the delightful fragrance of ripening vanilla beans and the perfume of flowers. Great clusters of scarlet trumpet-flowers dangled from the tips of slender vines, and from the tops of many of the trees drooped long garlands of huge white and blue flowers that resembled sweet peas; some of these blooms were two inches in diameter. There were also clumps of terrestrial orchids on some of the rocks, with slender spikes of deep purple flowers waving daintily under the impulse of each passing breeze.

Seven days after leaving Cochabamba, we came suddenly upon the little cluster of grass and bamboo houses known as Todos Santos; there were exactly eight of them, two of which were of large size, partially enclosing

a wide plot of ground carpeted with soft, green grass; tall forest hemmed in the settlement on three sides, and the Rio Chaparé, flowing through deep banks, formed the boundary on the fourth side. The largest building was occupied by the *intendente*, or Federal agent, who generously provided us with accommodations; in addition to the several living rooms, there was an immense ware-room stored with hides, salt, and other articles of commerce. The other houses were occupied by families of Bolivians who



FIG. 6.



FIG. 7.

FIG. 6—The moss-draped forest of the subtropical zone in the *yungas* of Cochabamba.

FIG. 7—Quechua hut in the *yungas*.

possessed land or concessions in the neighborhood and owned numbers of Indians of the Yuracaré tribe; these latter lived in long sheds built in the rear of the dwellings of the people they served. There was also a small church, but no shops of any description. In spite of its inconsiderable size, Todos Santos is a place of importance because it serves as an outlet for commerce from Cochabamba, and Bolivia in general, and is the port of entrance for hides from Trinidad, and merchandise entering by way of the Amazon and Madeira-Mamoré Railroad. A small steamer, the *Ana Katarina*, was tied up against the bank waiting for the water to rise sufficiently for her to proceed down the river; this boat plies more or less regularly between Todos Santos and Trinidad, and requires three days for the downward trip, and five days coming up. From Cochabamba to Trinidad is a distance of approximately 265 miles, 165 overland, and an additional 100

on the river. During the dry season, steam navigation on the Chaparé is very irregular, but canoes of large size and native paddlers may always be had. During the rainy season there is a small steamer or launch every fortnight.

Several years before, the Government had, by law, abolished the practice of keeping Indians in a condition of semi-slavery and had ordered all owners to turn them over to the missions; this, however, had not been done,



FIG. 8.



FIG. 9.

FIG. 8—A crude shelter of stones and brush erected by Quechua Indians in a river bed. A white flag waving overhead announces that *chicha*, an intoxicating beverage, is for sale within.

FIG. 9—The principal building in Todos Santos.

and each Bolivian family living at Todos Santos had a number of Yuracarés in its service. Not far from the settlement were a number of clearings, some of considerable size, where fruits and vegetables were cultivated for the benefit of the *amos*, as the owners of Indians are called; the Indians cleared the ground, cultivated it, and then brought in the results of their labor, receiving nothing in return. They seemed fairly contented, however, and did not appear to be suffering from ill-treatment. They frequently spent days at a time in their shelters on the edges of the fields, or on hunting and fishing trips far from their homes.

Every Yuracaré woman kept a number of Amazon parrots which she looked after carefully and refused to sell, even at a good price. Upon asking the reason for this I was told that they rear them for the sake of the tail-

feathers, which are in great demand by the Aymarás. A parrot will grow three crops of feathers a year, each of which is worth fifty *centavos*. The Aymarás from the vicinity of La Paz send down agents at regular intervals to purchase these feathers, as they use them in making ornaments worn during their annual festivals. In the branches of one of the tall trees near the village a neat little hut, resembling a Philippine tree-dwelling, had been built of bamboo and leaves. Indians armed with bows and arrows concealed themselves in this house, forty feet above the ground, and shot many of the birds which came to feed on the growing fruit; other Indians, hidden about the base of the tree, watched the birds as they fell, gathered them up, and skinned or plucked them. In this way quite a number could be shot without alarming a feeding flock.

The forest around Todos Santos abounds in wild life. Squirrel-monkeys (*Saimiri*) are very numerous and travel in troops of from twenty to fifty individuals; we saw them daily, playing in the trees, and feeding on fruits, buds, and insects. They are delightful little pets, and one that we owned spent the greater part of the day catching the mosquitoes which infested our habitation. It searched every nook and crevice for insects, and one of its chief pastimes was to look through a pack of cards in the hope of finding mosquitoes between them. Harpy-eagles also are very plentiful and feed on the squirrel-monkeys to a great extent, as they are easy to catch. However, monkeys are not the only animals which suffer; we one day found the remains of a sloth that had been dropped by an eagle; the entire forepart had been eaten away.

There were numerous trees covered with vivid, scarlet blossoms, scattered throughout the forest and forming gaudy little islands of color which stood out very conspicuously amid the green tree-tops. These trees are known as *madre de cacao* because they are frequently planted in cacao groves to shield the young plants from the sun. The flowers contain so much nectar that numbers of birds feed upon them, including parrots, macaws, and orioles; when the brilliant blooms fall into the river they are greedily snapped up by fish.

Of small birds there was such a variety that it would be impossible to mention all of them; but one in particular deserves attention: it is a species of manakin called "child of the sun" by the Yuracarés, who look upon the tiny creature with reverence and do not harm it under any circumstances. The bird is not as large as a sparrow, but is of stocky build, with a bright orange-red head and neck, the remainder of the body being black. As it whirs from branch to branch it makes a loud sputtering, crackling noise which reminds one of a bunch of small, exploding fire-crackers. The female of the species is of a dull green color.

At Todos Santos, as elsewhere, local migrations of birds in the heart of the tropics were several times forcibly brought to our attention. We had been hunting in the forest a number of weeks and were pretty well

acquainted with its inhabitants; suddenly a species entirely new to us appeared in great abundance in all parts of the region; each member of the expedition, including the native assistants, brought in specimens of it the same day. This can be explained only by the fact that flocks of these particular birds had arrived suddenly from some distant part, probably attracted by a fruit or insect which chanced to be plentiful at the time, and upon which they fed.

Several miles from port and entirely concealed by the forest, stretches a lagoon of considerable size; it is connected with the Chaparé by a small, brush-clogged creek, but the water is stagnant and filled with decaying vegetation and detritus. Masses of bushes and swamp grass grow all along the borders, and in some sections the surface of the water is covered with floating, aquatic plants. As may be supposed, many species of birds live both about the water and in the dense thickets that line the banks. Among the former was the rare little sun grebe, but it was by no means abundant; the few solitary individuals we saw were always surprised out in the open water, and, after giving a series of hoarse, loud cries either flew or swam as rapidly as possible to the nearest clump of vegetation that offered a secure retreat. Graceful jacanas stepped about daintily on the lily-pads; their toes are very long and give the feet a wide spread, thus enabling the birds to walk on the floating little islands of water hyacinths and wild lettuce; for this reason the natives call them *pájaros de Jesú Cristo*, because they can walk on the water. Several species of flycatchers and large, noisy wrens (*Donacobia*) lived in the partly submerged bushes; we found several of the bulky, domed grass nests of the former, but it was almost invariably impossible to reach them, as they always harbored colonies of biting ants which rushed out in maddened frenzy when the nest was touched; however, the birds and ants seemed to live in perfect harmony. In the tangles of tall bamboo growing on the bank and drooping out over the water, lived flocks of hoatzins, and numbers of several species of dendrocolapline birds or wood-hewers; also an occasional water turkey and cormorant. Many black and white ibises soared above in circles and at a great height; they acted not unlike vultures, but the long, outstretched neck and legs immediately gave a clue to their identity.

The forest was full of surprises; one morning my companion encountered a tamandua ant-eater which was on the ground and refused to realize that the close proximity of man meant danger; my companion was but lightly armed and shot the tough, thick-skinned animal with the 32-bore auxiliary tube of his shot-gun and number 12 shot—an unheard-of feat. It was, however, not always necessary to go into the forest to hunt; the open plot in which the settlement lay attracted many birds, such as tanagers, vermilion flycatchers, swallows, and others, which were never found in the forest; and small mammals in abundance lived in the houses. We frequently caught five species of rats in a single house in one night, and

at least two species of bats lived in the palm-leaf thatch of the roof. Some of the rodents, particularly a large spiny rat, lived under the floor, while others made the walls and ceiling their homes; each species seemed to adhere more or less closely to its own part of the dwelling, thus dividing the houses into well-defined "life zones." The natives are very fond of the flesh of the spiny rat and often begged for any which chanced to come to our traps. Ocelots were not wanting in the neighborhood; they visited the hen-houses occasionally at night, but never entered by the doors, preferring to tear holes in the side of the structures; they killed a large number of fowls, on one occasion nearly twenty on a single visit, prompted apparently by the mere lust for killing.

At night vampire bats came out in hordes; they attacked everything from human beings down; even the few miserable pigs kept by the Indians were severely bitten and kept up a continuous squealing as the bloodthirsty creatures settled on them, usually at the base of the ears, and began their painful operations. The worst sufferers by far, however, were the mules. As soon as the sun set, our peons brought the animals to the corral and strapped canvas covers over them; this precaution, however, was of little avail, for the bats attacked all exposed parts, causing the mules to kick and roll with the result that their covers were soon torn off. We went out frequently to watch these obnoxious creatures at work; after circling above their prospective victim a few times, they dropped suddenly, usually upon the neck or flanks, and at once began to bite and suck, making a grating sound with the teeth all the while. They paid no attention to us, although we stood but a few feet away, but clung with folded wings to their victim, perfectly motionless and in an upright position; if we moved they uttered a few squeaks, but made no attempt to fly until we reached for them and came to within a few inches, when they reluctantly fluttered up but almost immediately settled on the other side of the animal. Desiring specimens of them for our collection, we went one night to the corral armed with a butterfly net and, approaching one of the mules on whose back were a dozen or more bats, made a hurried sweep with the net; as the large, white bag of netting scraped the back of the nervous animal he sank to his knees with a groan of despair, wondering, no doubt, what new monster had swooped down upon him to add fresh suffering to his already unbearable existence. In the morning the mules were in a pathetic condition; blood continued to flow from the wounds made by the bats' sharp teeth, so that the ground was red, and the animals were covered from head to foot. It was always necessary to take them to the river and wash them, and then disinfect the numerous punctures; if this is not done flies attack the sore spots, infesting them with their larvae, and the animals die of blood-poisoning. After three nights we were compelled to start the mules back to Cochabamba, as they were on the verge of exhaustion.

While at Todos Santos we learned of a mission among the Yuracaré

Indians, about twelve miles distant, near the Rio Chimoré. We expressed a desire to visit it, but the *intendente* told us that such a move was impossible. He said that the priest in charge of the mission was absolute monarch of the territory under his control; that he would permit no one to come near his retreat; and that this mandate had never been disobeyed. Such statements made the place seem all the more alluring, and we were eager to go there at almost any cost; we devised many plans which we hoped would lead to an interview with the priest, but all of them failed miserably; finally, however, the opportunity came to us in an unlooked-for manner. A misfortune to one person frequently comes in the guise of a blessing to another, and so it happened in this instance. As we were pursuing our work one afternoon in the open corridor in front of our room, a long canoe drew up at the river bank and a priest, followed by a dozen Indians, stepped ashore and marched across the clearing to the *intendente's* quarters. We immediately recognized him as Padre Fulgencio, the missionary of whose despotic rule we had heard so much; but he did not even glance at us as he passed. While we were debating upon some diplomatic move which might serve as an excuse for an interview—for now or never was the time to obtain the coveted permission—he suddenly emerged from the house and came straight to us. A few curt remarks were exchanged and then he related his trouble. To make a long story short, he was suffering from a severe toothache; it had kept him awake many nights, and at last he was forced to come out of his retreat in search of a remedy. The *intendente* could do nothing for him; could we do anything?

How I thanked my lucky star for a limited knowledge of medicine! After an examination, conducted with much formality, the trouble was pronounced curable. He submitted bravely to the injection of cocaine, and soon after was relieved of the aching member. Tears rolled down his cheeks as he expressed his gratitude, and then, taking note of the work upon which we were engaged, he suddenly asked: "Why don't you come to the mission? I have four hundred Indians who spend several days each week in hunting; they can take you anywhere and also bring you all kinds of animals." We needed no urging, and within five minutes the day was set when porters in abundance would come to convey our equipment, and we should start on our journey to the mysterious stronghold of Padre Fulgencio and the boundless jungles bordering the Rio Chimoré.

WESTERN CANADA AND THE PACIFIC

By **WALTER S. TOWER**

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Two rival Canadian ports on the Pacific coast are of special interest at this time in view of the prospective opening of a Hudson Bay route to Europe for western Canada's wheat fields and the strong leveling tendencies in cereal distribution that have their origin in the war. Vancouver is an established port, having all the strength that grows out of a fixed place in the commercial scheme. Its competitor, Prince Rupert, 400 miles north, is new and untried. It hopes to become a Pacific emporium and to rival not only Vancouver but the cities of eastern Canada. It is already the terminus of the Grand Trunk Pacific Railway. What are its tributary economic areas? In the commercial race that goes hand in hand with the swift agricultural development of the Canadian prairies, what are its prospects of success? To answer these questions one must look not only at the resources of the regions that feed these two outlets but also at the principles of port development that apply the world over.

The advance of farming across the Canadian prairies has been marked by the steady northward extension of the zone of active development, largely because of better climatic conditions in the north for the production of the chief commercial crops—wheat, oats, and flaxseed. Central Saskatchewan and the region westward to Edmonton, Alberta, quickly led in the heavy production of cereals. These newer farming localities lie to the north of the line of direct communication with the original Pacific outlet at Vancouver and occupy such positions with reference to other parts of the Pacific coast as to lead naturally to the consideration of building new railroads to new ports on the western ocean.

There are at least four large factors which obviously would influence the selection of routes to the Pacific from the Canadian prairies. In the first place, the distance to which the cultivated area is extended northward largely determines the practicability (or economy) of shipping by the original route (Canadian Pacific) to Vancouver. From the region of Edmonton, via Calgary, to Vancouver it is 100 miles farther and much more difficult (Fig. 5) than to more northerly Pacific points, as Prince Rupert. In the second place, the location of passes across the Canadian Rocky Mountains and of natural routes through the rugged belt to the west largely determines the feasibility of building new trans-Cordilleran railroads to connect the farming communities and the Pacific coast. There are a number of good passes across the main mountain ranges between the 49th and the 60th parallels, which represent the approximate limits of the possible

wheat-producing area. Some of these passes, however, are of little or no use to the region, because of unfavorable location with respect to producing centers or to trans-Cordilleran routes (Howse Pass; Fig. 1). Satisfactory routes through the belt of rugged highland four hundred miles wide must be sought along valleys, preferably those which extend all the way from the Rocky Mountains to the Pacific coast or, if necessary, along low-gradient valleys which head near each other on a low intervening divide (Fig. 1).

A third factor, equal in importance to either of the others, is the character and location of harbors, or sites for commercial ports, to be reached by these routes. British Columbia has a typically fiorded coast, which means

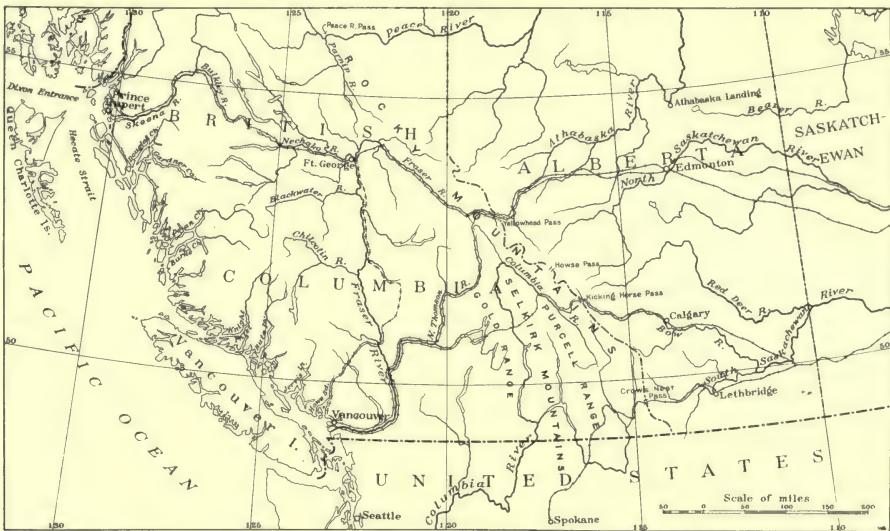


FIG. 1—Sketch-map showing rivers and routes of western Canada. Scale, 1:15,000,000. Note: For "Parnip R." (56° N.) read Parsnip R.

there are many deep, well-sheltered indentations (Fig. 1), more in fact than possibly could be utilized as harbors in the development of commercial centers for Pacific Canada. For various reasons, however, many of these indentations are unsuitable for port developments, as is illustrated by the typical case of Bute Inlet (Fig. 2). In some the water is too deep to provide good anchorages; some have such narrow, winding entrances as to make the passage of vessels difficult or unsafe; a majority are bordered by land too precipitous, or too rugged, to permit satisfactory development of an important commercial city; and nearly all of them are difficult to reach from the interior. To these general objections, applying in one way or another to almost all the indentations, there must be added the fact that nearly half the mainland coast of British Columbia lies back of Vancouver Island (Fig. 1), which means that, except for the indentations near the northern and the southern ends of the island, a serious handicap is imposed

by the long and roundabout route necessary to reach these harbors, which lie shut off from the open ocean by the island barrier. Finally, the natural resources and economic prospects of the country to be traversed would vitally affect profitable railroad development, and so influence the choice of routes.

Of the four enumerated factors apparently the greatest is the character and location of the valleys. Outside the routes made possible by the chief

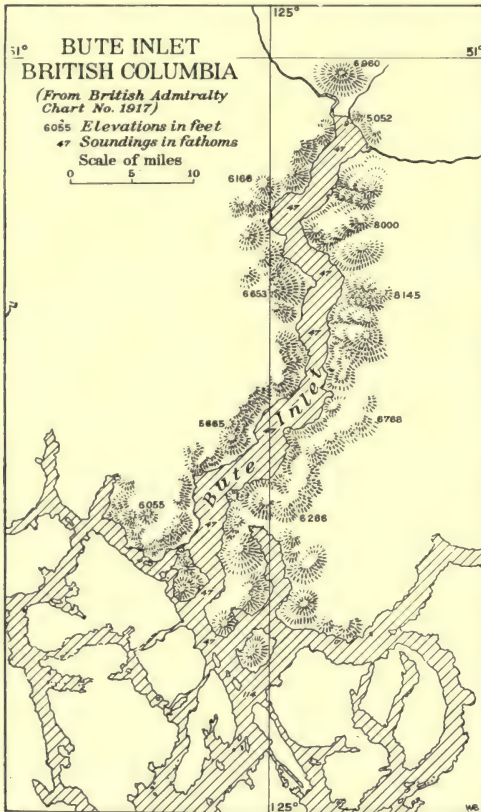


FIG. 2.—Sketch-map of Bute Inlet, useless for commercial purposes. Scale, 1:1,000,000.

Coast Range, and thus their valleys are the only ones which provide large gaps in the great topographic barrier of coastal British Columbia.

The Fraser has a system of three important tributary lines, one from the east, one from the northeast, and one from the north (Fig. 1), or, as they may be named according to tributary waters, the South Thompson-Fraser, the North Thompson-Fraser, and the main Fraser routes, uniting in the lower valley which comes out to the Pacific nearly opposite the southern end of Vancouver Island. These three tributary valleys, furthermore, head toward the eastern edge of the Cordilleran belt and not far from good passes

valleys, the high altitudes and extreme ruggedness would involve steep grades, high costs of construction and of operation, and other handicaps serious enough, presumably, to prevent any attempts to build trans-Cordilleran lines. Excluding valleys in British Columbia that lead into the United States or the territory of Alaska, the zone of possible port development is narrowed to the strip between latitude 49° and latitude $54^{\circ} 40'$, or a straight-line distance of only 400 miles. Within these limits, there are numerous streams entering the Pacific, each one of which has fiorded sections close to its mouth and potential harborage; but most of these streams rise in, or on the Pacific side of, the Coast Range and do not provide outlets for trans-Cordilleran routes (Fig. 1). Only two of the rivers, the Fraser and the Skeena, receive tributaries which rise very far to the east of the

over the Rocky Mountain barrier. The Skeena, on the other hand, has a much smaller system, enters the ocean close to the Alaskan boundary, and has only two tributary lines, one from the north and one from the east, the main Skeena and the Bulkley. Neither of these valleys heads close to the Rocky Mountains, but both must be approached from the east through the valleys occupied by the upper waters of Fraser or Peace River tributaries (as the Nechako and Oslinka).

In the four hundred miles between the Fraser and the Skeena, several rivers enter the conspicuous "channels" or "inlets," as they are there

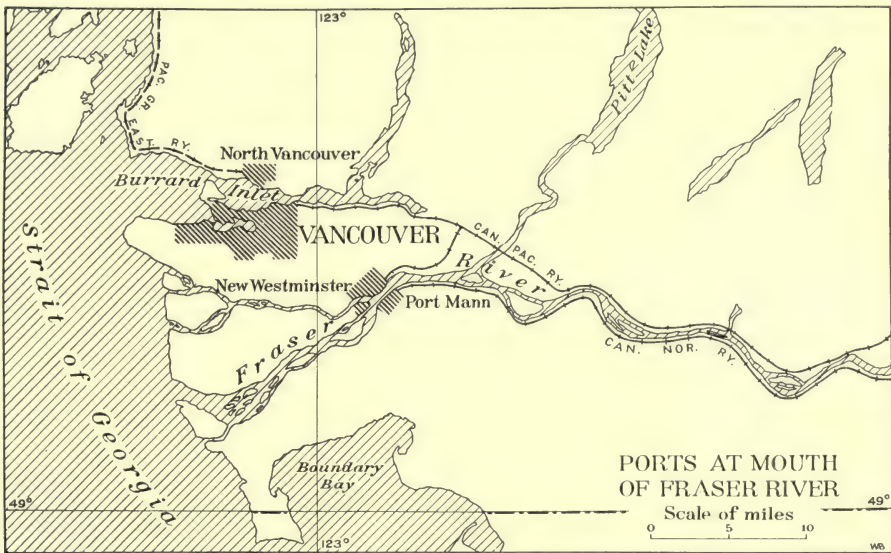


FIG. 3.—Sketch-map showing the ports near the mouth of the Fraser River. Scale, 1:800,000.

called, but they are of no commercial value. Nothing would be gained, for example, by seeking outlets from the Fraser River basin, in central British Columbia, over the divide of the Coast Range, into such valleys as those which lead to Knight, Bute, Toba, and Jervis Inlets (Fig. 1). The two rivers entering Douglas Channel and Gardner Channel north of Vancouver Island are only a hundred miles from the mouth of the Skeena. They are comparatively short streams, heading on the western slope of the Coast Range. The only other ones which are worth mentioning head east of the Coast Range: the Salmon River flowing to Dean Channel, and Bella Coola River to Burke Channel (Fig. 1). Between their headwaters and the tributaries (Blackwater and Chilcotin) of the Fraser system, however, there is the obstruction of a comparatively broad and high divide. Further, the route from prairie points via one of these valleys to the coast would be very devious, and the coastal topography is prohibitively rugged (Fig. 2).

There is not much difference in the quality of the harbors of Vancouver

and Prince Rupert;¹ each harbor is large enough and deep enough to accommodate all the shipping that it may be called upon to receive. They are admirably protected by lines of sheltering islands and prominent headlands (Figs. 3 and 4). Both have long usable water frontage, offering almost unlimited possibilities for wharf and dock development. Both have adjacent sites suitable for the development of cities of large proportions. The moderately hilly character of the land about the harbors makes town sites unusually attractive both from the standpoint of scenery and that of public health. The only notable difference between the harbors is in the character

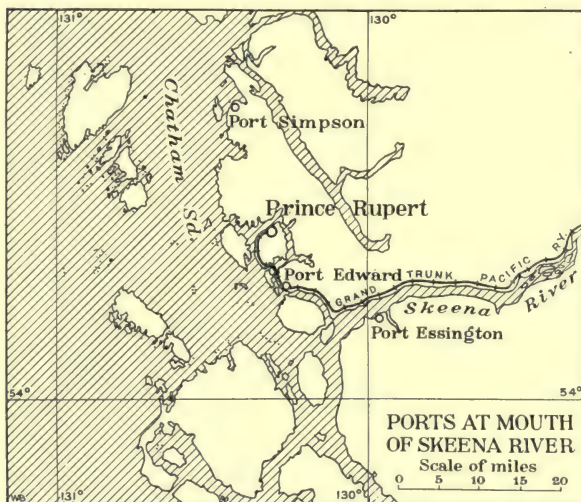


FIG. 4—Sketch-map showing the ports near the mouth of the Skeena River. Scale, 1:1,500,000.

and somewhat shorter entrance from the Pacific. However, this advantage is probably altogether too small notably to affect the development of Prince Rupert.

What is the character of the land adjacent to the two localities? Within a radius of a hundred and fifty miles from either port the land is rugged, heavily forested, with small agricultural possibilities, and for the most part not known to be especially rich in mineral resources. There is more cultivable land near the lower Fraser valley and on Vancouver Island, however, than there is near the lower Skeena valley and on the Queen Charlotte Islands, for it might almost be said that good agricultural land of any considerable extent does not exist within a hundred and fifty miles of Prince Rupert. There is also a difference in the character of the forests. Along the southern part of the British Columbia coast is found one of the most valuable commercial forests of fir, hemlock, and cedar in North America.

¹ Except for harbor conditions the factors affecting Vancouver may be said to cover the other towns of that district, including New Westminster, North Vancouver, and Port Mann; while Prince Rupert likewise covers the case for Port Edward, Port Essington, and Port Simpson (Figs. 3 and 4).

In the vicinity of Prince Rupert, on the other hand, where conditions (of climate especially) are less favorable, the trees are smaller, the stand is not so heavy, and there is a predominance of the less valuable kinds, like hemlock and spruce.

The Vancouver region appears in the present state of information to be superior in mineral resources. At all events, there is little reason to suppose that the productive coal fields of Vancouver Island are equaled by deposits in the lower Skeena basin.

Prince Rupert is nearer to Alaska; it is nearer to Oriental ports as far south as Shanghai; and it is the Pacific terminus of the shortest route (now and probably for the future) between eastern Canadian (or western European) localities and those Oriental centers north of Shanghai. Vancouver, on the other hand, is nearer to the United States, to the Panama Canal, to all points reached by way of the canal, and to places in the Orient south of Shanghai. The sailing and steamship routes most frequented in the Pacific lie mainly far to the south of Prince Rupert. Hence existing trade relations for the Pacific seem unlikely to lead to the passage of shipping close enough to Prince Rupert to make that place a convenient port of call. Shipping between Alaskan and southern ports, relatively unimportant, is the only exception to this condition. Vancouver, on the contrary, is much more favorably located with reference to the long-established (and probable future) shipping routes in the North Pacific, largely as a result of its proximity to the important Pacific ports of the United States.

The relative merits of the routes inland from Vancouver and Prince Rupert must be determined largely on the basis of (1) distances between the ports and their respective productive areas, (2) the potential resources of the Cordilleran section through which the lines run, and (3) the extent and character of the entire region from which traffic can be drawn. It may be noted, first, that a radius of 500 miles (air-line distance is in this case comparable to road mileage) from Vancouver as a center, includes all the Cordilleran (British Columbia) region south of latitude 56° , and the western margin of the prairies from the Peace River country on the north to the plains of southern Alberta, over a width ranging from a hundred to two hundred miles east of the Rocky Mountain axis. A similar radius from Prince Rupert as a center includes the greater part of central and south-western British Columbia, but only a relatively small strip of the prairies, mainly in the Peace River country and to the north. The area lying exclusively within the Prince Rupert radius, in north-central British Columbia and the northern prairies is less valuable economically than the areas lying exclusively in the Vancouver radius in southern British Columbia and the southern prairies. So far as mileage of land haul is a factor, Vancouver seems to have a substantial advantage in being nearer to large regions with good prospects.

The economic possibilities of the country traversed by railway lines in

per Fraser basin, about equidistant from the two ports. Agricultural and pastoral possibilities, however, are not likely to operate in a large way in the development of these areas during the next few years, mainly because the difficulties confronting agriculture in the Cordilleran region are serious enough to give the prairie lands all the advantage in attracting agricultural colonists and labor. Two facts alone are adequate to support this conclusion. (1) Most of the cultivable lands of the Cordilleran region are forested, and impose on the prospective farmer an expenditure of time, labor, and capital so great that the whole cost of preparing the land for plowing may be greater than would be justified by the expectable returns from its cultivation. (2) A good many tracts, properly classified as arable lands, are for climatic reasons suitable only for hardy cereals (oats, barley, rye), vegetables, and some small fruits; but for such crops there is little demand in that region or any other within reach.

The forest resources are far more significant to the development of the region, for much of the southern half of British Columbia consists of ultimate forest land. The best and heaviest stands are toward the south, in the section tributary to Vancouver. In the central part of the province, especially along the Nechako-Skeena route to Prince Rupert, large tracts of forest now have little or no commercial value (Fig. 8). Some large areas have been injured or destroyed by fires, mainly during the last quarter of a century. Other large areas are covered with a growth of small-sized and inferior spruce, hemlock, and poplar. These forests might be exploited profitably to produce pulp wood, posts, fence rails, railroad ties, and the like, were there a large accessible market for them. Very few tracts of good saw-log timber are found as far north as the 54th parallel, or the approximate vicinity of the Skeena route. The line tributary to Prince Rupert, therefore, lies near the northern limit of cultivable crops and of valuable commercial forests in British Columbia and cannot derive much advantage from these two resources.

In the matter of mineral resources few deposits comparable to those in the Selkirk and Gold Ranges and other parts of southern British Columbia have yet been found in the more northerly localities, though exploration is likely to reveal new riches; but no great commercial port ever has been developed by traffic resulting from the production of ores alone. The northern section seems quite deficient in supplies of fuels of good grade, as a result of which a serious handicap may be imposed on its mining development as compared with the southern section, where an abundance of high-quality coal is available, such, for example, as the coal from Vancouver Island and the Kootenay region. All the important coal fields now known in British Columbia and nearly all the great coal supplies of Alberta lie within a 500-mile radius of Vancouver, with the greater part of these fields tapped by lines of transportation which naturally are tributary to that Pacific port. On the other hand, only a small part of the coal fields of



FIG. 6—The coast of British Columbia near the mouth of the Skeena River.

British Columbia (such as the Telkwa field in the upper Skeena basin) and the northern (poorer) end of the Alberta field lie within a similar radius of Prince Rupert, while from many of these coal areas there are no natural lines of movement tributary to that port. The natural resources in the Cordilleran section, therefore, give an overwhelming advantage to the Vancouver region.

Turn now to a comparison of the prairie regions tributary to the rival ports. The distance from Vancouver is materially shorter than the distance from Prince Rupert to the prairie area which is now developed, or is likely to have any large development in the near future (Fig. 5). Thus Edmonton, typical of the northern part of the prairie area, is but 755 miles (Canadian Northern Railway) from Port Mann and is 955 miles (Grand Trunk Pacific Railway) from Prince Rupert. This means, of course, that through all of the strip of prairie country from the international boundary northward beyond the Athabaska valley, the distance traveled to Vancouver need not be so great as that to Prince Rupert, unless a direct line of railroad is built through Peace River Pass, via the Oslinka to the Skeena. Such a line has not yet been projected.

The southwestern part of the Canadian prairie country, especially that part west of the 105th meridian and south of the Saskatchewan River, is agriculturally less valuable than sections farther to the east and to the north, on account of the scanty rainfall. The development of irrigation projects in the region south and east of Calgary has produced some conspicuous results, as at Lethbridge; but this basis of progress is not at all comparable to the prospects for agricultural development in the more northerly sections without irrigation. Evidently, then, the better parts of the western prairies lie farthest from Vancouver and closest to the passes over the Rockies (Yellowhead and Peace River) by which the Skeena route may be reached. Will this suffice to give Prince Rupert a commercial development greater than that which Vancouver can attain?

The southern prairie section will seek its western outlet mainly via Calgary and the Kicking Horse Pass (Canadian Pacific Railway) through the South Thompson-Fraser route to Vancouver. In spite of heavier grades along that line (Fig. 5), any other western Canadian outlet would involve distances so much greater that it could not possibly compete successfully. For the northern section there are two low passes now occupied or in the future presumably to be occupied by railroads to the Pacific. The Yellowhead Pass west of Edmonton is crossed by the Grand Trunk Pacific to reach the Nechako-Skeena route to Prince Rupert, and by the Canadian Northern to reach the North Thompson-Fraser route to Port Mann. The Yellowhead Pass offers the natural western exit from much of the good prairie section north of the Red Deer River and from all the section about Edmonton and north through the Athabaska country. The Peace River Pass, about 250 miles to the north, presumably will be crossed by a railroad

which will serve as the logical western exit from that most northerly agricultural region, via the Parsnip either to the main Fraser or to the Nechako-Skeena route or via the Oslinka to the northern Skeena (Fig. 1).

From these two passes, Yellowhead and Peace River, as is not the case with Kicking Horse, routes lead both to Vancouver and to Prince Rupert. The Yellowhead Pass is nearer (200 miles) to Vancouver than to Prince Rupert (Fig. 1), while Peace River Pass is nearer to Prince Rupert than to Vancouver. From the Yellowhead, via the North Thompson-Fraser route to Vancouver, grades are lower (Fig. 5) than via the Nechako-Skeena route to Prince Rupert. Thus, all prairie traffic seeking an exit by the Yellowhead would find shorter distance and more favorable grades to the coast if routed to Vancouver instead of Prince Rupert.

From the Peace River exit, for the future agricultural development in the north, the best railroad route to the coast lies along the Parsnip, into the upper waters of the Fraser (North Fork) above the junction of the Nechako, for which route a railroad (extension of the Pacific Great Eastern) already has been projected. Thus the traffic from the Peace River region, following that route, would find somewhere near Fort George on the Fraser a point from which there are two ways of reaching the coast: westward to Prince Rupert (Grand Trunk Pacific Railway) through the Nechako-Skeena route, and southward to Vancouver (Pacific Great Eastern Railway) through the main Fraser route.²

With approximate equality of distance, the southern route has a distinct advantage in handling traffic from the dividing point at Fort George.

It is necessary, now, to take into account the destinations of western Canadian products, for the coastwise distance between Vancouver and Prince Rupert might offset the advantage of taking goods to the port nearer foreign destinations. It already has been noted that Prince Rupert is nearer to Alaskan and northern Oriental markets, while Vancouver has the advantage in the case of southern Pacific and Atlantic markets. The comparative importance of these respective areas as destinations for Canadian staple exports is so well known that it needs little discussion. Agricultural products, lumber, and minerals from western Canada, all find their best markets in Atlantic and southern Pacific localities. For a long time to come, if not permanently, this condition will exist. There is, then, a strong likelihood that the bulk of the traffic, even from the more northerly part of the prairies, will be drawn toward Vancouver, because of favorable distances for the land haul, easy railroad grades, and location of the port with respect to principal foreign destinations. Even for traffic moving to Oriental markets it is not impossible that the saving of more than 200 miles in land haul would more than offset the shorter ocean carriage from Prince Rupert, 480 miles nearer Yokohama than is Vancouver.

² The Pacific Great Eastern leaves the main Fraser route at Lillooet, above the junction of the Thompson, and crosses two low divides to reach the Cheakampus River and Montagu Channel (Howe Sound), which are followed to North Vancouver. This saves some mileage but, more important, avoids the narrow lower Fraser valley, already followed by two railroads, with little room for another.



FIG. 7.



FIG. 8.

FIG. 7—One of the typical new towns springing up on the prairies of Saskatchewan.

FIG. 8—The "town" of Pacific, B. C., on the narrow flat of the Skeena River, 120 miles east of Prince Rupert. Note the steep slope in the background.

There is left to consider only the effects of incoming traffic on the development of these two commercial centers. It has been claimed repeatedly as one of the assets of Prince Rupert that its trans-continental railroad connections offer the shortest possible line of communication between the Far East and eastern Canada or western Europe and that this possibility of expeditious transportation ought to make the place an important center for handling Oriental wares for Canada, the United States, and western Europe. The savings of distance and time, however, compared with other routes from the Far East, are not great enough to weigh very heavily in the movement of anything except mails, perhaps passengers, and possibly the highest class of package freight. The area which can be served most easily by Prince Rupert, as an import center, now has and for a long time presumably will have only a rural population with but little demand for Oriental wares. There is small chance, therefore, for the immediate development of an import trade of any large proportions through Prince Rupert from China and Japan. The best prospect for the development of import trade at Prince Rupert is to be found probably in the fresh-fish traffic from northern British Columbia and Alaskan waters to markets in Canada and the United States. In that respect, Prince Rupert has a distinct advantage over any other Pacific port, because of the saving of time in transit for a perishable commodity; but, judging from other fishing centers, that activity is not likely to contribute greatly to the commercial development of Prince Rupert.

Vancouver, on the other hand, is close to more important centers of population both in Canada and in the United States with increasing demands for Oriental wares, the handling of which will, as heretofore, contribute materially to the commercial progress of that center. Of late years one of the large items in the traffic at Vancouver has been raw silk from China and Japan destined largely for factories in the United States. This traffic, for example, probably could not be diverted to Prince Rupert, because of the much longer land haul from the port to the ultimate destination. Thus Winnipeg, the common point on the eastbound journey for all western Canadian lines, is 1,748 miles from Prince Rupert and 1,484 miles from Vancouver. Similarly, other Oriental wares logically would enter in greater amounts through Vancouver, because of established lines of shipping, solidly intrenched commercial relations, and the number and distribution of people composing the market.

Putting together all these considerations of location, distances, character of tributary areas, routes of transportation, and distribution of population, the sum-total of geographic factors affecting the Vancouver center seems to insure it a continuance of prosperous development. On the other hand, the combination of factors affecting the Prince Rupert center is so unfavorable that only very slow and unimportant development seems to be in store for it for years to come.

CULTURAL FEATURES AND THE PHYSIOGRAPHIC CYCLE

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Does geographical environment control human distributions, industries, habits, customs, and other activities and qualities? How far does this control extend and through what agencies does it operate? These are some of the fundamental problems of geography. In an attempt to put the investigation of at least one aspect of the broader problem on a detailed quantitative basis, the writer has set the following query: To what extent are the location and distribution of cultural features, such as towns and clearings in the forests, controlled by topography; and how closely may the facts of location and distribution be correlated with recognized stages in the normal physiographic cycle? No attempt is here made to determine the effects of complications in the cycle.

STAGES IN THE PHYSIOGRAPHIC CYCLE

In order that there may be no confusion of meaning in the use of the terms that designate the various stages of the physiographic cycle, the essential topographic characteristics of each stage are stated briefly:

Youth: The greater part of the original upland surface still intact; valleys narrow, steep-sided, and without prominent flood-plains.

Late youth: Valleys wider and considerable parts of the original upland still undissected.

Early maturity: Fragments of the original upland still remaining, but occupying less than one-fourth of the area; valleys narrow and steep-sided, with minor bottom lands here and there along the larger streams.

Maturity: Original upland completely dissected; V-shaped valleys and ridgelike divides; slopes steep; flood-plains narrow and mainly along larger streams; valley-side profiles nearly straight lines, or convex upward.

Late maturity: Valleys wider at the bottom than in maturity; lower slopes gentle; upper slopes steep; divides narrow and relatively sharp; flood-plains conspicuous along streams; valley-side profiles concave upward.

Old age: Lower slopes gentle and valley bottoms wide; divide ridges narrow and becoming lower as the age increases; flood-plains broad.

Extreme old age: All slopes gentle; divides low and narrow; flood-plains broad.

CULTURAL FEATURES

For the sake of definiteness and simplicity, only four types of cultural features have been considered. These are: clearings in the forests (on maps

on which forests are shown), roads, houses, and towns. All of these are represented on the accompanying maps (forests being indicated by a darker tint on Figs. 4 and 5). Each of them is vitally related to the life and occupations of the people. From their location and distribution much can be determined concerning the life and work of the people, the nature of their farms, and the physical and social difficulties against which they must contend.

METHOD OF WORK

In order that the investigation might be put upon a quantitative basis and freed from personal errors the following procedure was adopted:

1. From the latest topographic maps, all on the same scale, a number of examples of topography in various stages of the physiographic cycle were chosen.

2. For study, a definite and uniform area, namely a five-minute rectangle on each map, was selected, care being taken to choose an area having a uniform type of topography throughout.

3. A graph was prepared, and the stages in the cycle were plotted along the horizontal axis, and percentages along the vertical axis. The stages represented were youth, late youth, early maturity, maturity, late maturity, old age, and extreme old age. The cycle was thus rather minutely subdivided in order to facilitate the placing of regions whose stages are intermediate between youth, maturity, old age, and the final stage of extreme old age.

4. Each area chosen for study was next classified under its appropriate heading and its proper position on the graph was plotted.

5. All roads on each rectangle were then measured and classified, as to location, in the following groups:

- (a) Bottoms. Roads along valley bottoms close to streams or on the stream flood-plains.

- (b) Interfluves or uplands. Roads on the upland ridges and divides.

- (c) Slopes. Roads distinctly on valley slopes, extending either along or up and down the slopes, unless distinctly pass roads.

- (d) Passes. Roads across valleys from upland to upland, or across divides from valley to valley.

The mileage under each classification was determined and its percentage of the total was calculated and plotted on the graph for roads, Figure 1. The same procedure was followed and the same classification was made for houses and towns, except that on some sheets displaying uniform topography the towns of the entire quadrangle, or of considerable parts of it, were counted. Any group of ten or more houses was classed as a town.

The percentages for houses and towns on interfluves, bottoms, and slopes were then plotted on their respective graphs, Figures 2 and 3. Smooth curves were drawn as nearly as possible through the points thus located.

The construction of the graph for towns differs from that of the others in that the percentages for all the maps of each stage were averaged and this average was plotted at the center of the space for that stage, because the number of towns on most of the quadrangles was too small to give reliable results if plotted separately.

The areas measured and plotted on the graphs represent considerable variety both in locality and in relief for each of the stages. It is note-

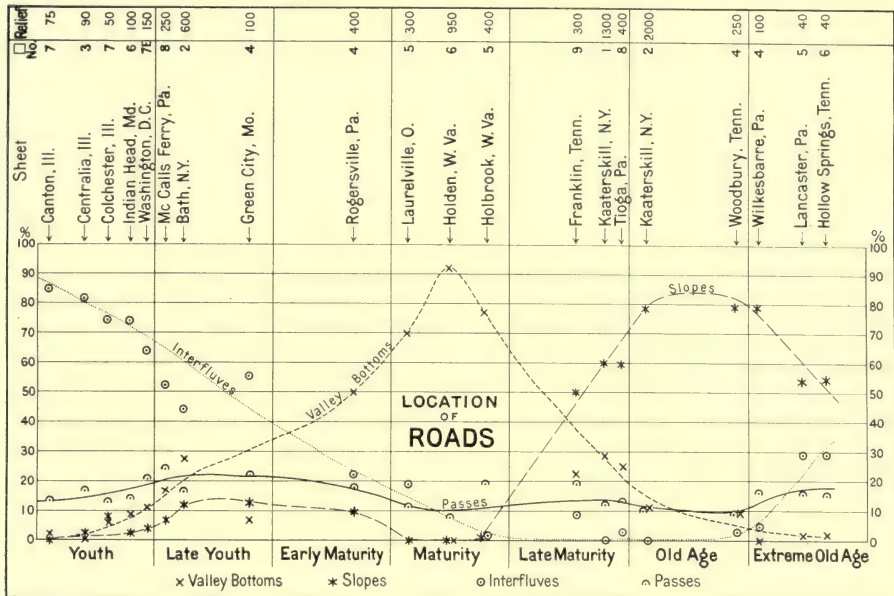


FIG. 1—Diagram illustrating the relation between the location of roads and the physiographic stage of the topography.

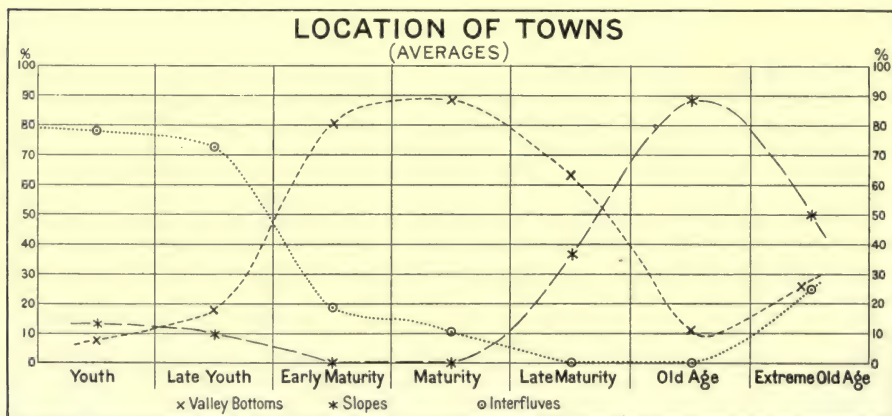
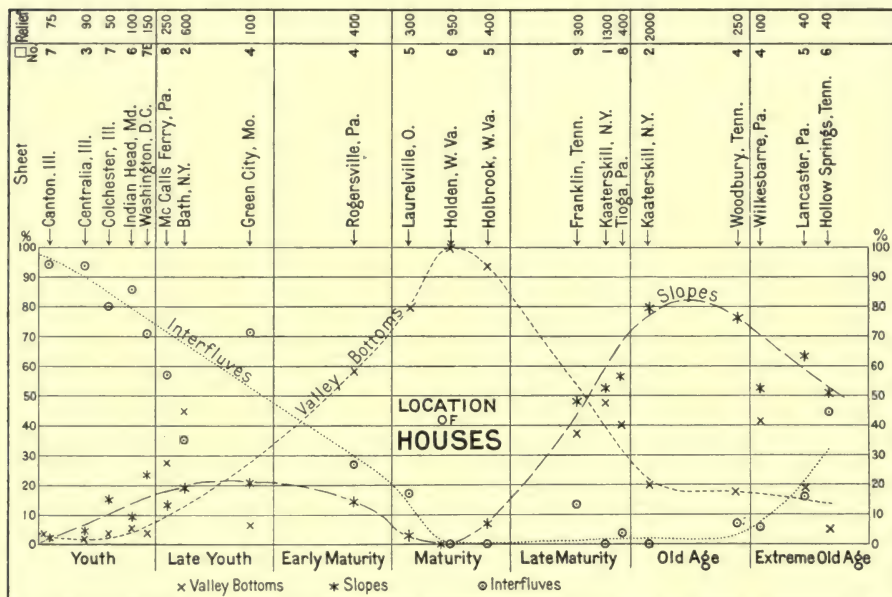
The stages of the physiographic cycle are plotted along the horizontal axis and the percentages of occurrence of roads on topography of a given stage along the vertical axis. Four types of roads are differentiated by symbol. The areas chosen for study, five-minute rectangles on the topographic sheets of the U. S. Geological Survey, are indicated in the upper part of the diagram, the position of each rectangle within its sheet being indicated by the numbers under the heading "No." (the nine rectangles, arranged in three rows of three, are numbered consecutively from left to right, beginning with the top and ending with the bottom row). The figures at the top of the diagram, headed "Relief," give the mean elevation in feet of each five-minute rectangle.

worthy that the correlation holds in its essentials for regions of considerable differences in relief, though it is plain that high relief tends to make the topographic control more nearly dominant.

ANALYSIS OF THE CURVES

Houses. In youth a large percentage—80 to 95—of the houses are on the uplands and only a few in the valley bottoms, Figure 2. On several of the maps a considerable number are located on the premature old-age topography at the heads of the larger valleys and are classified as on slopes. With advance toward maturity the percentage of houses on the

uplands decreases to zero, whereas for those on the valley bottoms it increases to 100. In late maturity and old age the percentage of houses on slopes increases to 60 or 75, while that for valley bottoms drops to less than 50. In extreme old age, locations on slopes and interfluvies dominate (the



FIGS. 2 and 3—Diagrams illustrating the relation between the location of houses and towns and the physiographic stage of the topography. For explanation of symbolism, see Fig. 1.

abrupt falling off of the curve for valley bottoms is due to slight rejuvenation in all the areas measured).

Roads and Towns. The graph for roads, Figure 1, repeats the essential features of that for houses, as would of course be expected. The only

noteworthy difference is the addition of the curve for "passes" which lies very uniformly between 10 and 25 per cent. The rise to 25 per cent in late youth is due to the increased width of the valleys while culture is still mainly on the uplands. The sharp rise of the road curve for "interfluves" and the fall for "bottoms" is similar to that for houses and is due to the same cause. The graph for towns, Figure 3, repeats all the essential features of the other two.

The graphs show clearly that there is a close correlation between the enumerated cultural features and the specified stages in the physiographic cycle. In nearly all instances the percentages for the different regions fall surprisingly close to the general curve. The similarity in the form of the curves for each of the three cultural features shows that the location of all is controlled in essentially the same way by the topography and that all are capable of the same topographic correlation. The location of cleared land, though not measured quantitatively, may readily be seen to accord with that of the other features. For the purposes of the following summary statement of the correlation it is, therefore, possible to group houses, towns, roads, and clearings together under the general head of "cultural features."

SUMMARY STATEMENT OF THE RELATION OF CULTURAL FEATURES TO STAGES IN THE PHYSIOGRAPHIC CYCLE

The correlations implied in the graphs may be verbally expressed as follows:

In youth what may be called *upland culture* prevails to the extent of 60 to 90 per cent of the total. Houses, farms, roads, and towns are on the uplands. Valleys are avoided and as a rule are left forested. The valleys are crossed only in passing from one upland to another (see Fig. 4).

As the stage of the topography approaches maturity and the flat upland areas decrease in relative proportions and the flats along the streams increase, there is every gradation to the second principal stage, maturity.



FIG. 4—Youthful topography on the plains of Illinois. Part of Canton, Ill., quadrangle, five-minute rectangle No. 7 (see explanation under Fig. 1). Note that culture is almost exclusively on the uplands. The eighth, quarter, and half-mile jogs of the roads by which the section-line system is made to conform to the topography is well illustrated in the southwest corner of the map.

The distribution of culture follows very closely that of the flatter land both in location and in percentage.

In maturity, with steep slopes and narrow ridge divides, *valley-bottom culture* prevails almost to the exclusion of all other types. All cultural features are closely con-

fined to the valleys, and the uplands and slopes are, in general, avoided (Fig. 5).

In late maturity and old age, when the valleys are wide and their lower slopes are gentle, *slope culture* predominates. All cultural features are prevailingly located on the slopes part way up from the streams. In valleys of considerable relief the roads with accompany-



FIG. 5—Typical mature topography in a region of considerable relief. Holden, W. Va., quadrangle, rectangle No. 6. Note the exclusive development of "valley bottom culture."

ing houses are most commonly built along the valleys part way up the slopes (see Figs. 6 and 7). The reasons for this location seem to be that thus the stream flood-plains and cut-bluffs are avoided, the ground is drier, and the houses are located nearer the centers of farms which extend from valley bottom to divide.

The correlation with the extreme old age stage cannot be satisfactorily made from the data on the graphs because of the slight rejuvenation which all the regions seem to have suffered. There is nevertheless a distinct tendency toward the development of the *unguided* culture, which would be expected as the plains condition is approached, and which is the characteristic type on plains.

BASIS OF THE TOPOGRAPHIC CONTROL OF THE LOCATION OF CULTURAL FEATURES

Topography, in its relation to human activities, may be analyzed into three components—relief, including elevation; slope, or inclination of the surface; and exposure.

Relief exerts its most direct and powerful influence through the work which must be done against gravity in ascending from one level to another. To escape the necessity of performing this work man avoids hill ascents whenever and wherever possible, consequently all cultural features tend to be so located with respect to the outside world and to one another that the least possible amount of climbing is necessary. In consequence, if the farms

of a region are on the uplands, there is a tendency for all the other cultural features to be located there also. Certain features, such as railroads, are more sensitive to gravity effects than others and are, therefore, more strictly limited in their location. They may, for instance, be confined to the valley bottoms in regions where all the other cultural features are on the slopes or the uplands. A good example of this is found on the Fayetteville, West Virginia, quadrangle, where the through-line railroads are confined to the valley of New River, though all other cultural features of the region, except certain coal mines and railroad towns, are on the uplands. Where the relief is great, the effect of altitude on temperature may be great enough to assume prime importance.

In its influence on human activities, particularly where agriculture is the prevailing industry, doubtless slope declivity is the most important single element of the topography. On slope depends the rate of run-off of the rainfall, and, to a large degree, the character of the soils, since the finer materials tend to be washed off the steeper slopes and the coarser, stony materials to be concentrated and left behind. Ease of cultivation is similarly conditioned by slope gradients. In all these respects the gentler slopes are most favorable, though there are exceptions due to specialized industries like the grape-growing of the Rhine valley, where exposure exerts the dominating control. The influence of exposure to sun and wind varies greatly under different conditions of climate. It is exerted directly, as well as indirectly through agriculture.

Of the three components of topography, slope seems to be the one which exerts the strongest influence over the location of cultural features in the regions included in this study. The graphs drawn to show the location of these features in relation to topography and stage in the cycle might almost as well be used to express the location of the flat or more gently sloping land, so closely do the two correspond. To express the idea briefly: *The*



FIG. 6—A specimen of late-mature or early-old-age topography on which slope culture is well developed. Kaaterskill, N. Y., quadrangle, rectangle No. 2. Onteora Park, a summer resort, probably owes its location abnormally high on the slope to a combination of the factors of elevation and the excellent view which the location commands.



FIG. 7—Slope culture in a late-mature valley in the Catskills (valley of Town Brook, Hobart, N. Y., quadrangle). Houses, roads, and the most important parts of the farms are on the slopes well above the valley bottoms.

topographic control over the location of cultural features is exerted mainly through the agency of slope supplemented by relief and, to a less degree, by exposure.

Such a close relation between slope and the distribution of cultural features is to be expected, particularly in a region like the United States, where agriculture on an extensive rather than an intensive scale is the prevailing industry. The farms are located on the more level land where the soil is best and cultivation is easiest. The houses and towns are located where the least amount of hill climbing is necessary in traveling from house to farm or from farm to town. The roads—the connecting links between these features—accord with them in location.

THE DOMINANCE OF TOPOGRAPHIC FACTORS IN CONTROLLING THE LOCATION OF CULTURAL FEATURES

To what degree topography dominates competing human factors in controlling the location of cultural features is a broad problem which has been touched upon only incidentally in connection with the present study. Two of the cultural features, namely towns and roads, supply data on the subject.

Towns. Towns of two types, rural or agricultural, and mining towns, are represented on the maps studied. The former predominate; and their locations are obviously controlled principally by those factors which control the locations of farms, houses, and roads.

Unless topographic factors are strong enough to exert a dominating influence, it would be expected that the location of mining towns would be controlled by the sites of the mines. In order to test this theory, the distinctively mining towns on the quadrangles from which type areas were studied have been listed and the data on the topography and on the locations of the mines and of the towns have been assembled in the following table:

TABLE SHOWING RELATIVE TOPOGRAPHY OF MINES AND MINING TOWNS

QUAD-RANGLE	NAME OF MINING TOWN	TOPOGRAPHY OF NEIGHBORHOOD OF MINE	LOCATION OF MINE	LOCATION OF TOWN
Holden, W. Va.	Holden	Mature	Near bottom	Bottom
	Cora	Mature	About 100 ft. up slope	Bottom
	Stone Branch	Mature	150 ft. above main stream in gulley	Bottom
	Kitchen	Mature	150 ft. up slope	Bottom and on lower 50 ft. of slope
Eccles, W. Va.	Wevaco	Mature	800 ft. up slope	Bottom
	Dorothy	Mature	About 1,000 ft. up slope	Bottom
	Keeferton	Mature	800 ft. up slope	Bottom
	Kingston	Mature	500 ft. up slope and in valley heads	Bottom
	Herbertson	Late mature	1,200 ft. up slope near top	On slope 100-150 ft. above stream
Canton, Ill.	Alden Mine No. 6	Youthful	Upland	Upland
	Alden Mine No. 5	Youthful	Upland	Upland
Several smaller communities: mines and communities both on uplands.				

The table shows that the mining towns are located in strict accord with the topography. On mature topography they are in the valley bottoms,

irrespective of the location of the mines; on the one example of late-mature topography the town is on the slope; and on the youthful topography all cultural features, including both mines and towns, are on the flat uplands.

The number of observations tabulated is, of course, too small for generalizations, but the table furnishes interesting confirmation of the results of the graphs and serves to indicate that topography is the controlling factor in the location of these mining towns as well as of the strictly rural communities.

Roads. With respect to the roads, the maps studied cover regions in which the road pattern is irregular and those in which the rectangular section-line system prevails. The latter system, if consistently carried out, must inevitably conflict seriously with the topography in any but plains regions, in which case either the section-line system must be modified or it must be followed in direct defiance of topography. By reference to the graph, Figure 1, it may be seen that for topography in the youthful stage the percentage of roads on uplands, bottoms, and slopes is about the same for the quadrangles, e. g., Canton, Centralia, and Colchester, in which the section-line plan has been followed, as for the quadrangles, e. g., Indian Head and Washington, in which the roads are not laid out with reference to any definite system. An inspection of the Canton map, Figure 4, shows that the section-line plan has been modified by means of jogs on one-half or one-fourth mile lines in such a way that the general plan is retained but the roads are located in reasonable conformation with the topography.

APPLICATION OF RESULTS

This paper represents only the beginning of the quantitative study of the distribution of population by a new method, and its conclusions, which are based upon limited data and are primarily applicable to those regions in which agriculture is the principal industry, should not be made the basis of unqualified generalizations. Especial importance is attached to the method and to the graphic representation of the results. The study was purposely confined to regions whose topography represents, as nearly as could be found, various stages in the ideal physiographic cycle as developed on dissected plains or plateaus. Obviously the results cannot be applied without modification to regions whose topography is complicated by remnants of surfaces belonging to two or more cycles or to those whose climatic and cultural conditions are notably different, and it is doubtful if it can be applied at all to regions—basin regions for example—whose topography is not definitely a product of the normal cycle of stream erosion, and such regions make up a very considerable portion of the earth's surface.

The location of cultural features and the distribution of population are controlled by a number of factors, among which topography, climate, the occupations of the people, and their grade of civilization are perhaps most important. The influence of topography on locations is conditioned to a greater or less degree by the other factors. In attempting to work out, on

a broad basis, the correlation between topography and the location of cultural features by the method outlined above, either of two plans may be adopted: (1) the correlation may be worked out separately for each principal type of climate and for each of the leading industries, or (2) certain conditions, e. g., humid climate and modern agriculture, may be taken as the *normal*, or perhaps better, the *standard* conditions, giving rise to the *normal* locations and distribution with respect to topography in the various stages of the ideal cycle; while variations from the normal brought about by complications of the cycle, different climatic conditions, different grade of civilization, or specialized industries may be considered as modifications due to particular causes. To illustrate: The accompanying graphs represent the correlation for a region of humid temperate climate where extensive modern agriculture is the dominant occupation of the people. Adopting the first plan, similar graphs might be prepared for regions where tree culture or grazing prevails or for those where intensive hoe cultivation is practiced. They might also be prepared for regions of arid, tropical, or cold climates. Following the second plan, which on the whole seems to be preferable, and accepting humid climate and modern agriculture as standard conditions, modifications of the normal locations and distribution would be recognized as such and related to their causes. For example, on youthful topography the normal is "upland culture," on late mature and old age topography it is "slope culture." In high altitudes, the climatic influence of elevation may make the uplands too cold and wet for habitation and compel settlement of the topographically unfavorable valley bottoms. Similarly, in an arid climate the necessity for irrigation may limit the culture of a young region to the valley bottoms. In the tropics, on the other hand, the cooler climate of the higher altitudes puts so high a premium upon altitude that not only may the flat uplands of youth be occupied to the fullest extent, but even the less favorable, narrow uplands of maturity may be utilized. Still greater altitude in the tropics, as in the Andes, may render the uplands fit only for the nomadic herdsman while the steeply sloping valley sides, on account of their more favorable climate, are laboriously cultivated. Each of these conditions brings about a modification of the normal distribution of cultural features which is easily traced to its cause.

Modifications of the normal locations due to complications of the cycle fit readily into the scheme. For instance in many parts of the Appalachian Plateau (see Big Bend quadrangle, W. Va.) late-mature topography has been rejuvenated and the bottoms of the broad valleys of the earlier cycle have been sharply trenched by the precipitous valleys of the new. With respect to the new cycle "upland culture" would be normal; with respect to the old cycle "slope culture" would be expected. As a matter of fact both expectations are fulfilled by the location of practically all cultural features on the gently sloping benches above the youthful valley sides.

The factors which constitute the basis of control exerted by topography—

namely relief, slope, and exposure—are so fundamental that it would seem that they must have weight whatever the industry or the stage in civilization may be, though either of the latter must modify the result. If modern agriculture, with machine cultivation and transportation by wheeled vehicles, be taken as the standard in determining the normal location of cultural features, then it would be expected that industries such as grazing or tree culture would introduce modifications in the direction of less absolute topographic control. So, also, would a stage in civilization in which transportation is primitive and cultivation is done by hand. An entirely non-agricultural and mobile industry like trapping would probably be so little controlled by topography that its correlation with stages of the cycle would be impracticable. Pressure of population or specialized industries resulting in terrace agriculture bring about modifications in the location of cultural features whose significance is the more marked when they are recognized as abnormalities due to specific causes. The location of cities and villages on crags and hilltops for defensive purposes offers another illustration of a modification of the normal readily recognized and easily traced to its cause.

Which of the plans mentioned above would yield the best results is open to discussion, but under either plan the application of the method to various parts of the world where climatic and cultural conditions are notably different is highly desirable.

BEARING OF LOCATION OF CULTURAL FEATURES ON THE BROADER PROBLEM OF THE INFLUENCE OF GEOGRAPHICAL ENVIRONMENT

If, in a given region, the location of houses, towns, and roads may be definitely correlated with the stage in the physiographic cycle, does it follow that the location of these features influences the life and character of its people? This is the ultimate problem to the solution of which this correlation is only the first step.

That the character of the topography exerts a very positive influence over the economic phases of life, and, through these, over the more subtle human qualities, will probably be conceded by all; but does the mere location exert a similar influence? To answer this question on a definite scientific basis will require long investigation, some of it distinctly in the realm of psychology, and will be the work of many years. A possible guiding principle may, however, be suggested. *The location of the farms, houses, and towns of a region determines the topographic environment and scenic outlook of the inhabitants.* Contrast, for example, the environment determined by youthful and by mature topography. In the one the people live on the uplands where they command the full sweep of land and sky. Their view is broad and open. In the other they live along the bottoms of the narrow, steep-sided valleys, hemmed in by hills. Their outlook is limited to their immediate surroundings; there are no broad commanding vistas.

The geographer can define the environment and classify and explain its elements: can the psychologist determine its effect in moulding character?

MARKLAND, OTHERWISE NEWFOUNDLAND

By W. H. BABCOCK

The name Markland, meaning Forest Land, must be, in one language or another, among the oldest geographical designations known among men. Nothing could be more natural to even the most primitive people than to distinguish in this way any heavily overgrown region which especially challenged attention, perhaps as a refuge or as a barrier. Its appearance in any form of record was, of course, very much later. As to Atlantic regions, the earliest instance other than Norse may be the "Insula de Legname" of certain fourteenth- and fifteenth-century portolan charts,¹ evidently given by some Genoese or other Italian navigator to Madeira, the latter name being a translation of the former, substituted by the Portuguese² after their rediscovery. Thus we might say that this island was the original western Markland, but for the fact that certain Greenland Norsemen had affixed the name long before to a region much farther west.

The earliest manuscript of the first distinct account of the Norse Markland is included in the compilation known as Hauk's Book,³ from Hauk Erlendsson, for whom and partly by whom it was prepared, necessarily before his death in 1334, but probably after he was given a certain title in 1305. Perhaps 1330 may mark the time of its completion. Along with divers other documents, it copies from some unknown original the saga of Eric the Red, sometimes called the saga of Thorfinn Karlsefni, an ancestor of the compiler, whose adventures as an early explorer of northeastern North America constitute a conspicuous feature of the narrative. Some parts of the saga of Eric the Red as thus transcribed, especially toward its ending, cannot be much older than the time of transcription, but verses embedded in other parts have been identified as necessarily of the eleventh century; and the body of the tale is, for the greater part, manifestly archaic.

Beside Hauk's Book, there is a corroborative, independent, but almost identical manuscript copy of the saga—No. 557 of the Arna-Magnæan collection at Copenhagen.

¹ Portolano Laurenziano-Gaddiano, 1351; see Pl. 5 of facsimile in Portfolio V of Theobald Fischer: *Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs*, 1 vol. of text and 17 portfolios containing photographs of maps, Venice, 1877-1886.

Catalan atlas, 1375, Pls. 11-14 in A. E. Nordenskiöld: *Periplus: An Essay on the Early History of Charts and Sailing Directions*, Stockholm, 1897.

Pareto map, 1455, Pl. 5 in atlas accompanying K. Kretschmer: *Die Entdeckung Amerikas in ihrer Bedeutung für die Geschichte des Weltbildes*, 2 vols. (text and atlas).

² M. d'Avezac: *Notice des découvertes faites au Moyen-Age dans l'Océan Atlantique antérieurement aux grandes explorations Portugaises du quinzième siècle*, Paris, 1845, pp. 8-9. See "I de Madera" on Benincasa map, 1482, K. Kretschmer, *op. cit.*, atlas, Pl. 4.

³ Fully set forth in A. M. Reeves: *The Finding of Wineland the Good*, London, 1890; summarized in W. H. Babcock: *Early Norse Visits to North America*, *Smithsonian Misc. Colls.*, Vol. 59, No. 19, pp. 64 *et seq.*, Washington, D. C., 1913.

This saga⁴ tells us:

"Thence they sailed away beyond the Bear Islands with northerly winds. They were out two *daegr* (days); then they discovered land and rowed thither in boats and explored the country and found there many flat stones (*hellur*) so large that two men could well spurn soles upon them [lie at full length upon them, sole to sole]. There were many Arctic foxes there. They gave a name to the land and called it Helluland.

"Thence they sailed two *daegr* and bore away from the south toward the southeast and they found a wooded country and on it many animals; an island lay off the land toward the southeast; they killed a bear on this and called it Biarney (Bear Island); but the country they called Markland (Forest Land).

"When two *daegr* had elapsed they descried land, and they sailed off this land. There was a cape(*ness*) to which they came. They beat into the wind along this coast, having the land on the starboard (right) side. This was a bleak coast with long and sandy shores. They went ashore in boats and found the keel of a ship, so they called it Keelness (Kjalarness) there; they likewise gave a name to the strands and called them Furdustrandir (Wonder Strands) because they were so long to sail by. Then the country became indented with bays [or "fiord-cut," as Dr. Olson translates] and they steered their ships into a bay. . . . The country round about was fair to look upon. . . . There was tall grass there." A very severe winter, however, drove them far southward to a warmer bay, or *hop*, where they dwelt for nearly a year among the characteristic products of Wineland; but at last withdrew after an onslaught of the Indians.

Probably it was from this narrative that Arna-Magnæan Manuscript 194, an ancient geographic miscellany, partly in Icelandic, partly in Latin, derived the following statement, generally ascribed⁵ to Abbot Nicholas of Thingeyri who died in 1159.

"Southward from Greenland is Helluland, then comes Markland; thence it is not far to Wineland the Good, which some men believe extends from Africa, and if this be so there is an open sea flowing between Wineland and Markland. It is said that Thorfinn Karlsefni hewed a 'house-neat-timber' and then went to seek Wineland the Good, and came to where they believed this land to be, but they did not succeed in exploring it or in obtaining any of its products."⁶

The above view of the relative positions of these regions along the coast

⁴ A. M. Reeves, *op. cit.*, pp. 42 *et seq.* This work gives facsimiles of the pages in Hauk's Book dealing with the saga of Eric the Red, as well as the printed text in Icelandic, also a translation and notes distinguishing slight divergencies of Arna-Magnæan MS. 557. I have followed the latter as slightly preferable and equally authentic and archaic in substance. W. Hovgaard (The Voyages of the Norsemen to America, New York, 1914, p. 108) translates a little differently from Reeves in details but gives much the same purport.

⁵ For example by Joseph Fischer: The Discoveries of the Norsemen in America, With Special Relation to Their Early Cartographical Representation (translated by B. H. Soulsby), London, 1903; ref. on pp. 7-8.

⁶ Thus quoted in A. M. Reeves, *op. cit.*, p. 15. See also W. Hovgaard, *op. cit.*, p. 79, where the obscure passage in the fourth line above is rendered "Karlsefni cut wood for a house ornament."

is also illustrated in the well-known map⁷ of Sigurdr Stefansson (1570, or 1590, according to Storm) which was evidently based on surviving Icelandic traditions.

There is great verisimilitude in the Karlsefni narrative and these later derivative records. Their geography agrees convincingly with the facts of the actual coast line from north to south—namely, first a desolate region, cold, bare, and stony, the appropriate home of Arctic foxes; secondly, a game-haunted and very wild forest land, untempting to settlement, unhelpful for agriculture, but a hunter's paradise; thirdly, the warmer country to the south, well suited to cultivation and even producing spontaneously various kinds of edibles, notably the large fox grapes from which wine might be made. Helluland, the first, remains, as Labrador and perhaps Baffin Land, nearly unchanged excepting some slight uplift of the shore line; Markland has suffered great inroads of the lumberman's axe, but still as Newfoundland contains much heavy timber in its western part; Wineland, the third, has become the chief seat of American civilization east of the Alleghany mountains. But in the time of the Norsemen and long afterward, Newfoundland was a veritable Markland, a land of woods, down to its eastern front.⁸ Its rediscoverers and earliest settlers found it so; and the maps of Cantino⁹ and Canerio,¹⁰ both attributed to 1502 and certainly not much later, exhibit the great island pictorially, under different names, as a mass of woodland with tall trees standing everywhere, apparently thus commemorating the most distinctive and conspicuous natural feature of the land.

Some have urged that the southern part of Labrador may have been Markland; but its trees of any considerable size are to be found only by following up inlets far into the interior where the Arctic current has less power to chill; there is nothing to indicate that conditions were very different then in this regard; and to judge by the narrative itself we must not conceive of the Norse visitors as pausing to explore deeply without allurements, but rather as hastening down the shore in quest of warmer regions and ampler pasturage for their stock which they carried with them, also of a good warm site for settlement, such as Leif had already reported. They were primarily colonists, not explorers of the disinterested or glory-seeking type. It was most natural to sail on; noting only what they could discern from the sea, or by a brief boat-landing. This would hardly give them the idea of a forest land in any part of hard-featured, ice-battered Labrador.

It is probable that, like some later navigators, they would not think of

⁷ First reproduced by T. Torfaeus: *Historia Vinlandiae Antiquae*, Copenhagen, 1705 (translated by J. G. Shea in *Catholic Historical Magazine*, 1888). Reproduced later by various authors, notably G. Storm: *Studies on the Vineland Voyages*, *Memoires Soc. Roy. des Antiquaires du Nord* (Copenhagen), N. S., 1888, pp. 307-370.

⁸ F. Nansen: *In Northern Mists* (translated by A. G. Chater), London, 1911, 2 vols.; reference in Vol. 1, p. 323. Cf. R. Whitbourne: *A Discourse and Discovery of Newfoundland*, London, 1622.

⁹ F. Nansen, *op. cit.*, Vol. 2, pp. 350 and 351. E. L. Stevenson: *Maps Illustrating Early Discovery and Exploration in America, 1502-1590*, New Brunswick, N. J., 1906, Pl. 1.

¹⁰ K. Kretschmer, *op. cit.*, atlas, Pl. 8, map No. 1.

the Straits of Belle Isle as other than a fiord or inlet, after the pattern of the great Hamilton Inlet farther north; and if they guessed Markland to be an island it would be on quite different grounds—chiefly the natural tendency (which persisted until long after their time) to consider every western discovery insular; but they would at least be alive to the distinction between treelessness and an ample forest cover, and we see that in point of fact they did distinguish the regions on just this score.

Certainly this might involve the inclusion of Nova Scotia in the second of the three regions; and there have been many to champion this peninsula as distinctively Markland. But other features of Nova Scotia attracted the attention of Karlsefni's party and gave parts of that land an individuality distinguished from that of the forest country. The great cape Kjalarness, which seems to have been the northern horn of Cape Breton Island, and the exceedingly long strands, which may now be represented in part by the low front of Richmond County, are duly recorded, with no suggestion of their belonging to Markland, the region farther north. Also on the Stefansson map above referred to, the name *Promontorium Winlandiae* is applied to a long protuberance apparently meant for this part of Cape Breton Island, containing the counties of Victoria and Inverness, and the much earlier statement in Arna-Magnæan Manuscript 194 concerning the sea running in between Markland and Wineland seems to mark all south of Cabot Strait as belonging in some sense to the latter region. No doubt the name Markland may sometimes have been used with vagueness of limitation; but on the whole it seems most likely that Newfoundland was Markland almost exclusively. It seems practically certain, at the least, that the characteristics first noted in Newfoundland supplied the earlier regional name.

In many of the discussions of this exploring saga there has been too great a tendency to localize the territorial names, as though Wineland for example must denote a small area or short stretch of coast. Professor Hovgaard, recently, has even suggested that there may have been two Winelands—Leif's Wineland being much farther south than Karlsefni's, the name in each case standing for some one site or place and the territory immediately about it. This does not accord well with one of the notes on the Stefansson map, which gives Wineland an extension as far as a fiord dividing it from "the America of the Spaniard." That may be read as meaning Chesapeake Bay and must at any rate be taken to suggest great extension for this region, since the *Promontorium Winlandiae*, as already stated, obviously marks its upper end. Markland need not be conceived as of equal size, for in truth it represents at most only the wild and wooded interval between the hopelessly void and barren north and the great habitable, comfortable, and fruitful region stretching far below; but so much of parallelism holds as will forbid us to anchor the name to any one locality on the Newfoundland shore. Doubtless the long sea front of the great island as a whole is entitled to the name.

No doubt it is surprising, in view of the deep impression which Markland obviously made on the Norsemen from nearby treeless Greenland and Iceland, to find so few subsequent references to the name or indications of a knowledge of the region. There is a well-known and often cited instance recorded in Icelandic annals—in one instance nearly contemporary—of a small Greenland vessel storm-driven to Iceland in 1347, after having visited Markland, the latter name being presented in a matter-of-course way, much as though it were Ireland or the Orkneys. This has sometimes been taken as evidence of a regular timber traffic between Greenland and Markland during the preceding three centuries and more. It shows at least that acquaintance with the more southwestern country had been kept really alive thus long, and that it was not a half-mythical figure on the frontier of knowledge, to be doubtfully sought for, but territory that one might visit without claiming the reward of new and daring exploration or causing any extreme surprise. What Markland had to offer was so decidedly what Greenland needed, and the repetition of Karlsefni's voyage thus far was at all times so feasible, that one must suppose the trips to and fro were not wholly intermitted between 1003 and 1347. Only they have left no clear and unquestionable trace.

Perhaps the nearest approach thereto is a fifteenth-century map¹¹ preserved in the Ambrosian library in Milan, which presents Greenland (Illa Verde) as a great elongated rectangle of land in northern waters, having a concave southern end. Below this, beyond a narrow interval of water, appears a large round island, the direction certainly calling for Labrador or Newfoundland, probably the latter. The minimizing of the distance between these land masses may indicate some report of the ease with which the crossing was effected. At any rate, unless we are prepared to set aside the testimony of the map altogether as mere fancy work, we must acknowledge that some one had a general impression of land in mass south or southeast of Greenland and reasonably accessible therefrom.

The name Brazil given to this island on the map and its disc-like form link it to the long series of "Brazil islands," approximately in the latitude of Newfoundland, on the medieval maps, beginning with that of Dalorto (1325).¹² Usually, as in this last instance, they have the circular form—sometimes, however, being annular, with an island-studded lake or gulf inside, and sometimes being divided into two parts by a curved channel. Usually, too, the station of this Brazil is pretty near southern Ireland, off the Blasquets, but sometimes it is carried out into mid-Atlantic, and in the

¹¹ A. E. Nordenskiöld: *Bidrag till Nordens äldsta Kartografi*, Stockholm, 1892, Pl. 5. Also (reduced) in F. Nansen: *In Northern Mists*, and in T. J. Westropp: *Brazil and Legendary Islands of the North Atlantic*, *Proc. Roy. Irish Academy*, Vol. 30, Section C, No. 8, 1912, Pl. 20, opp. p. 260.

¹² A. Magnaghi: *Il mappamondo del genovese Angellinus de Dalorto (1325): Contributo alla storia della cartografia medioevale*, *Atti del Terzo Congr. Geogr. Italiano, tenuto in Firenze dal 12 al 17 Aprile, 1898*, Florence, 1899, Vol. 2, pp. 506-543.

sixteenth-century maps of Nicolay (1560)¹³ and Zaltieri (1566)¹⁴ it is taken clear across to the Banks of Newfoundland or a little nearer inshore. From various mutually corroborative indications, I have been impressed with the belief that it is probably a record of some early crossing of the Atlantic from Ireland; but whatever the explanation, Brazil Island remains one of the most interesting of map phenomena. Its name was somehow passed along to Terceira of the Azores, where there is still a Mount Brazil, and long thereafter to the largest of South American countries.

Its appearance near Greenland and as a substitute for Markland is not easily accounted for. The matter is indeed complicated on this fifteenth-century map by the appearance of a second Brazil (of the channeled type) in the middle of the Atlantic. It may be that the cartographer was familiar with this form and kind of presentation in older maps and did not feel warranted in giving up *that* "Brazil"; but had received convincing information of lands southeast or south of Greenland, with some suggestion of Brazil as a name traditionally associated with such discoveries, and so drew and named it. Undoubtedly the map is the work of a man well acquainted with the first disc form of Brazil and the later channeled or divided form, beside having some knowledge of later discoveries in Greenland and beyond.

There is a parallel to the two Brazils of his map in the two series of Azores on that of Bianco (1448).¹⁵ The latter cartographer retained the original Italian-discovered series, inaccurately aligned north and south, but showed also farther afield the islands of Portuguese rediscovery, properly slanted northwestward, omitting only Flores and Corvo, which the rediscoverers had not yet found or at least had not yet brought to his notice. Another map of about the same period makes the same double showing—certainly a curious compromise between conservatism and progressiveness.

There is perhaps no other news of Markland before it became Newfoundland, unless we may put some glimmer of faith in the much-discussed Zeno¹⁶ narrative, which embodies the tale of an Orkney islander wrecked on the shore of Estotiland (perhaps Escociland—Scotland) a little before the opening of the fifteenth century. He professed to have found there a people having some of the rudiments of civilization and carrying on trade with Greenland, but ignorant of the mariner's compass. The picture given is not incredible and perhaps receives some support from the really extensive works known to have been executed by the Beothuk¹⁷ of Newfoundland

¹³ A. E. Nordenskiöld: *Periplus*, Pl. 27.

¹⁴ K. Kretschmer, *op. cit.*, atlas, Pl. 19, map No. 3.

¹⁵ Theobald Fischer, *op. cit.*, Portfolio XI, Pl. 3.

¹⁶ R. H. Major: *The Voyages of the Venetian Brothers Nicolo and Antonio Zeno to the Northern Seas*, etc., *Hakluyt Soc. Publs.*, 1st Ser., Vol. 50, London, 1873; and F. W. Lucas: *The Annals of the Voyages of the Brothers Nicolo and Antonio Zeno in the North Atlantic*, etc., London, 1898—representing opposite sides of the discussion.

¹⁷ George Cartwright: *Journal of Transactions and Events during a Residence of Nearly Sixteen Years on the Coast of Labrador*, 3 vols., Newark (Engl.), 1792. Republished as "Captain Cartwright and His Labrador Journal," with an introduction by W. F. Grenfell, Boston, 1911; reference on pp. 16-25.

in their later and feebler, though not quite their latest days—such as extensive deer fences, to give their hunters the utmost benefit from the annual migrations. Granted a certain infusion of Norse blood, or even without it, there is perhaps nothing stated of the Escocilanders which may not have been true. As to the name, it is no more strange than Nova Scotia, which still occupies the coast just to the south, and it may have been applied in the same spirit.

Very early in the history of European colonization this Markland—which by its outjutting position was accused of being a New-found-land, again and again with varying designations during the ill-recorded centuries—took under the latter name the position, which it still holds, of the very earliest of the English colonies of the New World.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Presentation of the David Livingstone Centenary Medal to Señor Ballivián. On July 6, at the American Legation at La Paz, the David Livingstone Centenary Medal of this Society, whose award for the third time since its foundation was announced in the *July Review*, was formally presented by the American Minister, the Hon. John D. O'Rear, to the distinguished Bolivian geographer, Señor Manuel Vicente Ballivián. Invitations were issued jointly in the name of the legation and of the Sociedad Geográfica de La Paz. There were present, in addition to the members of the Geographical Society of La Paz, the Minister for Foreign Affairs, members of the diplomatic corps, and many prominent citizens. In his presentation speech Mr. O'Rear outlined in a graceful and effective manner the long services of Señor Ballivián in promoting geographical research, in encouraging exploration, and in keeping alive the spirit of scientific inquiry both in government publications and in the Bulletin of the Geographical Society of La Paz.

In replying Señor Ballivián said in part:

"The award which you make is all the more precious to me, Mr. Minister, in that this medal not only commemorates the daring explorations of Livingstone among the lakes and about the sources of the Nile in Africa, but also brings to mind the noble efforts made by that distinguished traveler, who, at the same time that he was making geographical discoveries, employed every possible means to put an end to the horrors of human slavery.

"Your country, Mr. Minister, by not allowing the centenary of that intrepid and expert explorer to pass unobserved, has interrupted the sadness we feel as a result of the European War, and has spoken to us, in words of peace and wisdom, of achievements whose importance is world-wide and eternal" (translation by this Society).

NORTH AMERICA

Merchant Adventurers of America. The "merchant adventurer" represents in our minds the spirit of English enterprise in Elizabethan times. The islanders who felt the inspiration of the sea became the creators of empire and of British wealth. Their contribution to geography was by no means slight. How this same sea-spirit was a living force in America about one hundred years ago is described by John Foord in an article entitled "Pioneers in Foreign Trade" in *Asia* for April, 1917. Many of the sailormen hailing from Old Salem and other parts of the Atlantic seaboard were descendants of members of the crews commanded by Drake and Frobisher; and they readily volunteered to man the privateers of the Revolution when a cordon of British cruisers, strung along the coast, was effectively blockading the republic. At first the incentive was prize money. Soon, however, the appeal of commercial ventures, combined with the development of manufacturing, made itself felt.

Great profits were to be made in those days in the trade of the Indies, East or West. Sometimes a vessel would be equipped for one of these two destinations only. More often both would be visited. In time, however, the Far Eastern trade became the most important. Starting with humble beginnings American traders soon succeeded in competing with the English. Many fortunes were made. It was customary to allow masters the privilege of carrying out their own "adventures." Of this privilege their friends took advantage, and many a commission, each constituting an "adventure," was entrusted to the sea-going captains. Mr. Foord cites a few instances such as that of Mr. John R. Tucker, a resident of Salem, who turned over one hundred Spanish dollars to Edward Stanley, master of the *Messenger*, with instructions to invest it at his discretion in foreign commodities. Mr. Tucker's "adventure" brought him \$193.57, almost 100 per cent on the investment, according to Mr. Foord.

A complete study of these American "adventures" would add picturesque passages to the history of early national times. The period in which they were undertaken was one in which people took an interest in foreign affairs. Their "adventures," whether modest or considerable, turned their thoughts to far-away places like Canton or Batavia. But the powerful attraction of a continental expanse of land to the west was to outweigh

the influence of maritime enterprise. Now that the day of adjustment between these two attracting forces seems at hand, Mr. Foord's lines fit in as a most timely reminder.

The Nitrate Caves of the South. The U. S. Geological Survey is looking into every report of the occurrence of nitrate and potash, substances which during the war have become even more valuable than formerly. Supposedly rich discoveries have turned out in each case to be of doubtful importance, although some historically interesting information has gained circulation as a result of the Survey's studies. It has been found that a cave in one of the Southern States was worked by the Confederacy during the Civil War for potassium nitrate. The method of extraction was very crude. The cave earth was shoveled into iron pots, where it was treated with water and heated over wood fires to leach out its soluble parts. The liquor was drawn from one pot into another and used for treating fresh material until it became a highly concentrated solution of nitrate salts. It was then drawn off and allowed to cool, whereupon the nitrate crystallized. The remaining liquor was then employed to leach fresh material and the crystals were separated and sacked for use (*U. S. Geol. Survey Press Bull. No. 331, August, 1917*).

Agricultural Meteorology in the United States. A comprehensive summary of the present status of agricultural meteorology in the United States has been presented by Professor J. Warren Smith to the Ohio Academy of Science (*Proc. Ohio Acad. Sci., Vol. 6, Pt. 5, 1916, pp. 239-264*). On account of the far-reaching effect of climate and weather on crop distribution and production, the scope of agricultural meteorology is wide. Unsuspected relations are found by comparing well-selected climatic maps with agricultural ones. For example, in Wisconsin, most of the cheese factories are where the mean summer temperature is below 70° F., while the creameries are in the regions warmer than 70° F. This distributional aspect is being studied in the preparation of the Atlas of American Agriculture by the Office of Farm Management with the collaboration of the other bureaus of the U. S. Department of Agriculture.

An investigation of the effect of weather on the growth of crops has not been undertaken in so comprehensive a manner. For corn, wheat, and potatoes, Professor Smith has already stated concisely some of the effects of weather on yields. Thus, with July rainfall 2 to 2½ inches, the average yield of the 30,000,000 acres of corn in Missouri, Iowa, Illinois, and Indiana is 23 bushels per acre; but with 2½ to 3 inches, the yield is 33. In other words, in this region, a half inch of July rainfall is worth ten bushels of corn per acre. The period immediately after blossoming, or August 1 to 10 in the middle of the corn belt, is the most critical in the growth of corn: relatively cool, moist, weather at this time favors the highest yields. Potatoes in Ohio are affected by July weather more than by that of any other month: relatively cool, wet weather is best. At some other times, dry weather is favorable. For winter wheat, Professor Smith finds little correlation of Ohio yields with the weather of any month except March, when warmth or lack of snow are favorable, and coldness or more than usual snowfall unfavorable. It appears that better yields in Ohio generally follow Januarys with bare ground. The answers to questions raised by these results and to other unexplained weather effects, such as on crop limits, on the work of fertilizers, and on seed-vitality, are left to future study. And for this the foundations are now being laid by Professor Smith as head of the Weather Bureau's new division of agricultural meteorology.

CHARLES F. BROOKS.

The Commercial Prosperity of Porto Rico. The trade relations between the newly created Territory of Porto Rico and the United States have a special interest through their rapid progress, made of late years and particularly since the beginning of the war. One of the most striking aspects of this development is the growing importance of San Juan as a distributing market for the Caribbean, a position in which a naturally favorable location has been supplemented by the establishment of good steamship service with the ports of the Atlantic States. San Juan is only four or five days distant from New York. In 1916 imports into the island from the United States amounted to \$41,591,944, a gain of 35 per cent on the figure for 1914. To this increase the demand from Santo Domingo contributed not a little, for the disturbed condition of this island prevented regular shipments direct from the United States. The second outstanding feature of Porto Rican trade development is the great expansion of the sugar industry. Two-thirds of the \$68,246,319 representing the 1916 exports to the United States is accounted for by raw sugar, the export value of which more than doubled the figure for 1914. While the higher value is in part due to the increased selling price of sugar the output has also made headway, and it is encouraging to note that the 1917 crop promises to establish a new record (H. F. Kupfer: *The New Territory of Porto Rico Unusually Prosperous, Dun's Rev.: Internatl. Edit., July, 1917*).

SOUTH AMERICA

Geographical Features of Potato Production in Bolivia. Many important trading towns on the plateaus of Peru and Bolivia have a weekly or annual "fair" for the sale and direct exchange of goods by barter. In such towns one of the most important places is the so-called "potato plaza," where sacks and heaps of potatoes are scattered about. To the stranger the number of varieties of potatoes is truly remarkable, but easily understood when he recalls that the Andean plateau is the ancestral home of the potato. Even in some lofty localities there may be found dozens of wild and inedible varieties. In the Bolivian and Peruvian tablelands and high mountain valleys the potato forms the chief and, in many places, almost the only vegetable food of the highland farmers and shepherds.

There has recently appeared a very instructive report on the Bolivian potato by the President of the Geographical Society of La Paz and recently the recipient of the David Livingstone Centenary Medal of this Society—Señor Manuel Vicente Ballivián (M. V. Ballivián and W. C. Tovar: *Noticia histórica y clasificación de la papa de Bolivia*, 22 pp., La Paz, 1914). The paper opens with an historical and descriptive account of the cultivation, manner of growth, habitat, uses, and varieties of the potato. In the section on classification it is interesting to note that 184 distinct varieties are listed. The name of each variety is given, the Spanish equivalent, and a brief description of its chief characteristics. There are three colored plates. The descriptive part of the paper gives some highly interesting accounts of the mode of preparation of the chief varieties now used. Perhaps the most striking item relates to the preparation of *chuño* for the caciques and other dignitaries. After being dried in the sun and wind and frozen on the bare ground at night the potatoes are soaked in water for two months, then dried again in the sun, and at last become very white. In relation to this custom one may see a curious sight on the Desaguadero River in western Bolivia. Here and there is a sack of potatoes lying in the shallow water near the bank and tied with a grass rope to a stake driven into the earth. Directly the whistle of the river steamer blows a boy may be seen running at full speed down to the water's edge and hauling on the rope, to see if the wash of the lumbering stern-wheeler has broken loose his submerged sack of potatoes.

The Influence of Weather on Argentine Agriculture. From the economic standpoint Argentina is primarily interesting as a producer of foodstuffs for export. In 1913 over two-thirds of the value of her exports was accounted for by wheat and maize. Argentina is the leading world exporter of the latter and in export of wheat ranks with Russia and the United States. But here as elsewhere the generally speculative nature of agricultural industry makes itself strongly felt: the crop variations are great. The year 1907-08 is remembered for the record wheat harvest, with a production of over 5,250,000 tons and an export of over 3,500,000. In the year 1913-14, with a much greater area under cultivation, the production was little more than 3,000,000 tons, with under 1,000,000 available for export. Fluctuations in the corn crop are even more marked. In 1909-10 the harvest amounted to 4,500,000 tons; in the succeeding year to less than 750,000 and in 1914-15 reached the record figure of 8,500,000.

While the locust plague is apprehended as a more or less important agency of destruction, the chief element of variability lies in the climatic irregularities, especially in the recurring periods of drought. The vital importance of the weather in Argentina, felt through its effect on the cereal crops, is well illustrated in the consternation lately caused by the embargo placed on wheat export. The study of Argentine weather, then, assumes a character of practical importance. In advancement of such a study the inauguration of a monthly bulletin by the National Meteorological Office is therefore most welcome (see note in the *July Review*, p. 60). The need of such a report as a complement to the daily weather charts has long been felt, but heretofore funds for the purpose have not been available.

The New Boundary between the Brazilian States of Santa Catharina and Paraná. The long boundary controversy between the states of Santa Catharina and Paraná was settled by an agreement ratified on October 20, 1916, at Rio de Janeiro. Through the courtesy of the National City Bank of New York, the Society is enabled to present the following notice of the revision, the full text of which appeared in São Paulo papers on October 21, 1916. Starting on the Atlantic coast the new line will coincide with the boundary agreed to since 1771 and will follow the course of the Rio Negro to its confluence with the Rio Iguaçu. It will there cross the bridge of the São Paulo-Rio Grande Railway and coincide with the tracks of this road as far as the junction with the branch connecting Porto União de Victoria and Palmas. Thence the line

will follow this railway until the Río de Jangada is attained. From this point the boundary follows the river to its source. Thence it proceeds in a straight line perpendicular to the meridians until it reaches the water-divide. It then strikes west towards the line which connects the sources of the San Antonio and Peperiguassú Rivers. Beyond, it is prolonged to the Argentine frontier.

Through this settlement part of northwestern Santa Catharina is added to the state of Paraná.

EUROPE

The British Canal System. The reconstruction of the New York State waterways, the recent opening of the Marseilles-Rhone canal, the proposed connections between the Danube and the Rhine, Oder and Elbe and other extensive canalization projects contemplated by the Central Powers are evidences of the general revival of interest in transportation by inland waterways (*Commerce Repts.*, 1917, Nos. 69 and 86, 1917; see also the note on the Main-Danube Canal in the *Scott. Geogr. Mag.* for April, 1917). On the Continent, indeed, the revival is not new. In Germany it began in the seventies. In two decades the waterborne traffic of the interior had increased 120 per cent. Like progress was made in Belgium and northern France. The former country in particular owes its great industrial growth to the development of its waterways. Across the North Sea conditions have been different. The British inland waterways have declined progressively from the days of the canal era that began with the industrial revolution and contributed so much towards it (compare B. C. Wallis: Central England during the Nineteenth Century, *Geogr. Rev.*, January, 1917). Since the advent of the railroad in the second quarter of the nineteenth century no new canals have been constructed, except the Manchester Ship Canal, which pertains to a different class. Improvements also have been few, and traffic on the major part of the 4,670 miles of canal and canalized river now existing is negligible. A few years ago the government, aroused by the contrasting conditions on the Continent, appointed the Royal Commission on Canals and Waterways. Its findings, published in 1909, showed, however, that negligence was in part due to physical difficulties. As compared with Continental conditions, at least in the plain of Belgium and northern Germany, engineering obstacles are great. The number of locks on the British canals testify to this. In fact some of the early canals, as those across the Pennines, show engineering feats of no mean order. Moreover the present condition of the waterways is adverse to the employment of mechanical traction, an improvement that has done much to increase the usefulness of the Continental waterways, and another limiting factor is the inadequate or irregular water supply that proves serious in some of the Midland systems, notably the Trent.

Today the stimulation given to waterborne traffic by the congestion on the railways renews the problem of their improvement. That a better utilization may well be effected under the present governmental control is the opinion expressed in the *Engineering Supplement of the London Times* (issue of February 23, 1917, with waterway map of Great Britain, 1:1,900,000, showing (1) canals and navigable rivers, (2) derelict canals, and (3) canals converted into, or sites used for railroads), which instances the successful operation of such canals as the Aire-Calder, the important system connecting the Yorkshire woolen towns with the Humber. In a later issue of the *Engineering Supplement* (April 27, 1917) the engineering problems are considered in an optimistic light.

The Severe Winter of 1917 in Scandinavia. Charles Rabot, in discussing the winter of 1917 in Scandinavia (*L'hiver 1917 dans la Scandinavie, La Nature*, April 21, 1917), points to the way in which extraordinary ice conditions hampered the Germans. For about two months, railway ferriage between Sweden and Denmark was frequently obstructed; and for two weeks early in February it stopped entirely. Other ships were caught in the ice or had to set back. In fact, one captain reported that there were two hundred ships stuck in the Skager Rak early in February; and Danish fishermen said that 33 German submarines were blocked in the ice of the Kattegat on February 7. Moving ice exploded many mines. This ice condition, which was the most severe since 1895, was the result of an extraordinary period of cold weather in southern Scandinavia, northern France and Germany lasting from late December till the middle of March. At Christiania, the temperature from December 23 to February 9 did not rise above freezing—a duration unique in the 56 years of observations. January, with a mean of -10.9° C., was 6.9° C. below normal—the coldest on record, although the absolute minima were not extraordinary. In Sweden, however, a temperature of -55° C. was observed at Vucnatjviken, a meteorological station at an altitude of 500 meters in Norrbotten, northern Sweden. There were some extraordinary snowstorms: one near Christiania on February 2-3 caused a disastrous avalanche. Another over all Norway

ten days later was so severe in Vardö that a woman was lost in the middle of the village; and houses were practically snowed in. On March 14 northern Denmark suffered the worst snowstorm in forty-five years, one which suspended railroad traffic in north Jutland.

The undersigned may suggest the following by way of explanation. In the seven weeks from February 9 to March 28, 1916, the temperature of the surface water passing through the Florida Straits averaged 23° C.—about 0.5° C. below normal. In the course of ten to eleven months some of this water arrived in the Norwegian Sea; and, being cooler than usual, weakened the Iceland cyclone. This allowed a westward extension of the Eurasian anticyclone with its attendant cold weather. CHARLES F. BROOKS.

ASIA

Recent Developments of the Bagdad Railway. A history of the negotiations leading to the construction of the Bagdad railway, together with an account of the state of construction, is given by H. Charles Woods in a recent article (*The Baghdad Railway and Its Tributaries*, *Geogr. Journ.*, July, 1917). The report of the completion of the tunnels in the mountainous sections connecting Anatolia with Syria is now confirmed. Through connection between Constantinople and Aleppo is therefore possible—a fact which is of interest because it adds greatly to the strength of the Turco-German position in Turkey.

Regarding the future of the line Mr. Woods justly assumes that the subject is one which is hard to forecast at the present time. The only certainty lies in the fact that the line will benefit the development of Asiatic Turkey's resources. The details of its operation depend entirely upon the international situation at the advent of peace. The question of internationalizing the line is one which will then come up for discussion. By its geographical position Turkey is a land in which internal problems are magnified to the point of assuming international importance. Mr. Woods gives numerical evidence of this fact by recalling that before the war mails conveyed from London to Bombay by the usual sea route required thirteen or fourteen days, whereas with the completion of the Bagdad line the time of transit will be reduced to between nine and ten days.

Additional Notes on the Population Density of Japan. In abstracting a short article by the writer in the November, 1916, *Review* on "The Distribution of People in Japan in 1913," the *Annales de Géographie* (March 15, 1917, pp. 151-152), in their usual admirable manner, present additional facts of interest, which it is desired herewith to credit to their proper source, as the abstract itself modestly gives no hint as to their authorship.

Although the high population density of the majority of the prefectures in the most densely populated zone of Japan is generally due to the presence of urban centers, the prefecture of Takamatsu, on the island of Shikoku, has 425 inhabitants to the square kilometer without the help of any important city. This is in the southern belt of dense population, which coincides with the so-called "median line" in the physical structure of the islands "determined by the work of Harada, Koto, Naumann, and formed of a chain of tectonic valleys and zones of sinking, interrupted here and there by gulfs, recent sediments and volcanic deposits. This line, according to Harada, marks structurally the limit between the outer coast of Japan, which is regularly folded and poor in volcanic rocks, and the coast inside, along the Sea of Japan, which abounds in *graben* and eruptive phenomena and forms a region of faulted arches." The great density of population of the empire in spite of its generally rugged surface is only rendered possible by the cultivation of rice, and Yezo was so long neglected by the Japanese as to seem still uninhabited among the dense populations of the empire because it was unsuited to grow rice.

MARK JEFFERSON.

POLAR REGIONS

Safe Return of the Members of the Crocker Land Expedition, and Resurvey of the Southeastern Coast of Ellesmere Island. On August 26 the relief ship *Neptune*, whose departure was announced in the July *Review* (p. 62), reached Sydney, Cape Breton, with the members of the Crocker Land Expedition. All were in good health and have since reached their final destination in the United States, MacMillan and Hovey arriving in New York some time ago. The trip from Etah took twenty-two days. Southerly winds had packed Smith Sound and Melville Bay with drift ice, and the ship was leaking badly on its arrival as a result of the constant hammering of the ice.

In the same telegram in which MacMillan announced the safe return of the party (published in the daily press of August 28) he described a trip made last spring along the southeastern coast of Ellesmere Island. The section covered extends from Cape

Sabine ($78\frac{3}{4}^{\circ}$ N.) to Clarence Head ($76\frac{3}{4}^{\circ}$ N.). This stretch of coast was surveyed roughly by Inglefield in 1852 (Correspondence Relating to Arctic Expeditions, 88 pp., *British Blue Book No. 82*, ordered to be printed December 20, 1852; reference on pp. 35-39 and map facing p 40), Kane in 1854 (E. K. Kane: *Arctic Explorations: The Second Grinnell Expedition*, etc., 2 vols., 1856, map facing p. 8 in Vol. 2), and, more accurately, by Hayes in 1861 (I. I. Hayes: *Physical Observations in the Arctic Seas*, with map, 1:1,200,000, *Smithsonian Contr. to Knowledge* 196, in Vol. 15, 1867). But all these delineations were based on surveys made from the decks of vessels, often by means of distant sights, as ice prevented a close approach to shore. They are thus naturally not always accurate as to details. MacMillan's sledge trip has corrected a number of these inaccuracies.

Starting from Etah (on the Greenland coast, $78\frac{1}{3}^{\circ}$ N.) on March 26, 1917, with three Eskimos, Smith Sound was crossed in four days. On the opposite shore open water forced the party to go south by way of Rice Strait, an interior channel separating Pim Island from the main body of Ellesmere Island. Blocked at Cape Herschel, a little farther south, MacMillan turned inland again and cut across the intervening promontory to Baird Inlet ($78\frac{1}{2}^{\circ}$ N.). Here, at Eskimo Point, at the northern entrance to the inlet, the walls of three stone houses and the remains of a boat were found on the site of the first encampment of Greely's starving party in 1883. Continuing south, MacMillan was completely stopped at Cape Isabella ($78\frac{1}{2}^{\circ}$ N.) by open water and an impassable ice-foot. Before turning back he searched the cape carefully and was fortunate in finding records left by Sir George Nares of the British expedition of 1876, also mail for H. M. S. *Discovery* and *Alert*, left by Sir Allan Young of the *Pandora*. They were legible and in fairly good condition. On the return to Etah, Baird Inlet was mapped.

Starting again from Etah on May 3, ice conditions were found unchanged. An inland route was therefore chosen leading across Cadogan Inlet to Paget Point ($78^{\circ} 10'$ N.). South of this point there was sea ice and traveling was easier. MacMillan notes various new features between here and Clarence Head. Between Paget Point and Cape Faraday ($77^{\circ} 40'$ N.) a very large glacier was discovered and named the American Museum Glacier. It is formed by the ice cap pushing over the edge of the land into the sea and is only second in size to its analogue, Humboldt Glacier on the coast of Greenland between 79° and 80° N.

The other discoveries reported relate to the existence of two islands, one south of Paget Point, the other in Talbot Inlet, just south of Cape Faraday, and the non-existence of Sonders Island ($77^{\circ} 10'$ N.). Throughout this region glacial activity has increased since the middle of the nineteenth century. The land is fairly buried in ice, which flows over and around the headlands and fills all the fiords.

On his return MacMillan camped in Peary's old hut at Cape Sabine and visited the second camp of Greely's starving party on the north shore of the cape and made a survey and took photographs of the locality. Throughout this sledge journey good sights for longitude, latitude, and azimuth were obtained at all salient points.

HUMAN GEOGRAPHY

The Cause of Pellagra, Disease of Mountain Countries. In 1906 public interest became aroused in a mysterious scourge that had long been known in Europe and that appeared to have been transplanted to America. By 1911 the epidemic had affected 30,000 people in an area including all but nine states in the Union, according to a paper by Benjamin Brooks (*Illustrated World*, January, 1916, pp. 642-646). The paper cited is accompanied by a map showing the distribution of the disease in America, and it is pointed out that there is a striking relationship between such distribution and the distribution of the older and more deeply eroded mountain ranges and the drainage basins of rivers originating in these mountains. The application of the words "new" and "old" are, however, unfortunately made, and some other factor than age is responsible for the distribution of the disease. The map in question cannot be commended in any scientific study of the disease. (For a similar map, of scientific worth, see map showing the relation of goiter in Europe to the underlying geological formation, in Berghaus' *Physikalischer Atlas*, 1892, Pl. 64.)

Experiments made on victims of the disease seem to show that it is caused by the colloidal silica in the food, and a cure has been found in sodium citrate. It is suggested that waterworks engineers introduce the proper alkali into the water systems of large towns. The prevention of pellagra has become more difficult in country localities, but broken limestone in the bottom of a cistern and the exclusion of surface drainage from ordinary wells are suggested as remedial measures. The interesting comment is made that in France, where the same land is plowed each year and where cultivations extends back over a much longer period, pellagra, once widely prevalent, is now disappearing.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

CANADA

Maritime Provinces, Newfoundland

HOWLEY, J. P. **The Beothucks, or Red Indians: The aboriginal inhabitants of Newfoundland.** xx and 348 pp.; maps, diagrs., ills., bibliogr., index. University Press, Cambridge (Engl.), 1915. \$6.50. 12 x 9½.

Mr. Howley, who for forty years was connected with the Geological Survey of Newfoundland—begun by the late Alexander Murray, F.G.S.—was attracted to the subject of the aboriginal inhabitants when the survey of the valley of the Exploits River was started in 1868. In this valley many relics of the Red Indians were found, and traces at that time of their deer fences were in evidence (see also Mr. Babcock's paper on Markland in this number of the *Review*, pp. 314-315). Time and scanty records have much handicapped Mr. Howley in his work, but he has most industriously prosecuted his search for evidences of the habits, vocabulary, and origin of this long-extinct people and has given us the result of his labors in a most interesting volume. In the preface he says that he has used his best endeavors "to preserve from oblivion the principal facts relating to this interesting but unfortunate section of the human family."

In his account of the Beothucks, Mr. Howley quotes the narratives of the early voyagers who visited the New World and who recorded their intercourse with and their capture of a few of the natives, whom they carried to Europe. Some of the narratives cannot be depended upon as relating to Newfoundland. For instance, Richard Edens, in 1555, and Fabian, another chronicler of contemporary date, mention that Cabot brought to England three of the natives, "which he presented to the King (Henry VII) in the fourteenth year of his reign," viz. 1499. None of these writers is considered reliable, as the information they published was mostly obtained from Sebastian Cabot's statements, which, it is generally conceded, were not truthful. As Mr. Howley says, "the accounts of the Cabot discoveries are of such a meager description, and are, moreover, so conflicting and unreliable in most respects that we can cull very little from them that is really trustworthy; consequently their references to the people met with on these shores might apply to any of the inhabitants from Cape Chidley to Florida." The landfall of Cabot is a much-disputed point, and as it is not certain that he ever saw Newfoundland any testimony of his respecting the aborigines is of no value.

In Gaspar de Cortereal's account of his voyage in 1500, it is related that a number of the Indians were brought to Lisbon. The description given of them shows that they must have been Eskimos and not Indians. In his second voyage he was lost. During the sixteenth century it is recorded that natives from North America were brought to England and some to France. In the records of the voyages of Jacques Cartier, 1534-1535, we get the first reliable description of the Beothucks, or natives of Newfoundland. From this time onwards, it appears that very little attempt was made to open up an amicable intercourse with the aborigines, which was no doubt due in part to their timidity and to the ruthlessness of the Europeans who visited these shores and who shot down these people at sight. Hence it is that we have no certain knowledge of their origin. For over three hundred years they were known to Europeans as inhabiting Newfoundland. They were pictured as a people of good stature and well made; of a light color, and not darker than some French people. They broiled their meat and fish, which they were in the habit of preserving by drying, and they clothed themselves with skins. Here on the nearest point of America to Europe, in the oldest of England's colonies, has lived, flourished, and become extinct in its own orbit a primitive nation.

Was this tribe of Indians related to those tribes which occupied the neighboring continent or was it *sui generis*? Mr. Howley speaks of the theories advanced by early writers that these Indians were descendants of the Norsemen (see Mr. Babcock's paper, above, pp. 314-315), who, tradition asserts, discovered America in the tenth century; but

on an examination of the vocabulary, gathered from some of the Beothucks who were brought to St. John's in the early part of the nineteenth century, when an attempt was made to hold friendly intercourse with them, it has been held that such could not be the case. Some authorities assert that they were decidedly of Algonquin stock and were related to the Pawtuckets and Pequots of New England. Professor G. Latham of the Anthropological Society of Great Britain gives it as his opinion that they were a separate branch of the Algonquins, whilst the late Albert S. Gatschet of the Bureau of American Ethnology of Washington, who took infinite pains in comparing the Beothuck vocabulary with that of the many dialects of the Indian tribes of the mainland, was decidedly of the opinion that the language possesses no real affinity with any of these, that it is a mistake to suppose they were Algonquins, or yet Chippewans.

From the evidence compiled by Mr. Howley it is impossible to form any definite conclusion as to the origin of the Beothucks, yet there can be little doubt that they must have come originally from the mainland of America and by way of the narrow Straits of Belle Isle. When they came to Newfoundland can only be guessed at, but it must have been certainly many years before the discovery of America. That they existed in the island up to 1827 and that since then no trace of them can be found is chronicled by Mr. Howley, who is of opinion that they migrated to the Labrador coast about that time.

H. W. LE MESSURIER.

GANONG, W. F. **An organization of the scientific investigation of the Indian place-nomenclature of the Maritime Provinces of Canada.** *Trans. Roy. Soc. of Canada*, Ser. 3, Vol. 9, 1915, pp. 375-448.

G[ARNIER], A., edit. **Relation d'un naufrage sur l'Île Royale, 1780-1781.** *Bull. Soc. de Géogr. de Québec*, Vol. 10, 1916, No. 3, pp. 154-167; No. 4, pp. 214-229. [This narration of a shipwreck on Cape Breton Isle (Île Royale) during the winter of 1780-81 is extracted from the journal of Ensign M. S. W. Prenties. The relation was first published in London, 1782.]

MCINTOSH, D. S. **A study of the Cow Bay beaches.** Maps, ills. *Proc. and Trans. Nova Scotian Inst. of Sci.*, Vol. 14, Part II, 1915-16, pp. 109-119. Halifax. [The author does not find any evidence pointing to recent elevation of the coast line. See reference in Professor D. W. Johnson's paper "Is the Atlantic Coast Sinking?" in the February, 1917, *Review*, p. 137.]

MACKAY, A. H. **The phenology of Nova Scotia:** (1) 1912; (2) 1913; (3) 1914; (4) 1915. Maps. *Proc. and Trans. Nova Scotian Inst. of Sci.*, Vol. 13, 1910-14, pp. 250-258; pp. 347-355; Vol. 14, Part I, pp. 57-65; Part II, pp. 133-140. Halifax. [Notes on the date of the advent of spring as indicated by the budding of characteristic plants, etc.]

MORRIS, DANIEL. **Newfoundland and its forest resources.** *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 8, pp. 352-366.

— **Nova Scotia, Province of: Annual report of the mines: 1915,** 181 pp., diags.; 1916, 174 pp., diags., ills. Dept. of Public Works and Mines, Halifax, 1916 and 1917.

WRIGHT, W. J. **Moncton map-area, New Brunswick.** *Summary Rept. Geol. Survey of Canada for 1915*, pp. 179-185. Ottawa, 1916.

— **Nova Scotia, Province of, Map 150A. Ponhook Lake sheet No. 72.** 1:63,360. Geological Survey, Dept. of Mines, Ottawa, 1916.

UNITED STATES

Western States

BEADLE, J. B. **Progress in reclamation of arid lands in the western United States.** Map, ills. *Ann. Rept. Smithsonian Inst. for 1915*, pp. 467-488. Washington, D. C., 1916.

The progress that has been made in the transformation of the arid west and in the creation of opportunities for homes for citizens is summarized in this article. Mr. Beadle has been in a position to watch the changes and to select for description the salient points in the great works which have been initiated under the terms of the Reclamation Act of June 17, 1902. He has outlined the principal engineering features and has given large consideration to the geographic or topographic features which have contributed to the practicability of the various undertakings. Especial attention has been given to the factors which have made it possible for settlers to obtain a permanent foothold on the soil.

The amount of money derived from the proceeds of the disposition of public lands and utilized in the building of works for reclaiming the arid lands totals up to nearly \$100,000,000. With this sum there have been constructed some of the largest works for conservation of water by storage that have ever been undertaken, such, for example, as the Roosevelt Dam in Arizona; the Arrowrock Dam in Idaho, 350 feet in height, the highest in the world; the Shoshone Dam in Wyoming; and the Elephant Butte Dam in New Mexico. In all a hundred dams, large and small, have been built, supplying water to nearly 10,000 miles of irrigating canals and distributaries. There have been built also 25 tunnels, through which some of these canals run, and nearly 65,000 canal structures, big and little. But greater than the engineering work is the transformation of over a million acres of desert into productive farms, and the fact that in the past year crop values of nearly \$20,000,000 have already been realized, although the irrigated lands themselves have not yet been wholly subdued and brought under cultivation.

Climate, soil, and adequate water supply contribute to success, but after all the man himself is the essential item. With the true pioneering spirit, willing to endure privations, to work hard, to practice thrift, to use his brains, and to persist in good works, the settler has every reason to look forward to a comfortable and prosperous home. Experience has shown that there is probably no occupation in which the average man can be more assured of success. For one reason, in these new communities he is on a par with his neighbors. All are struggling, all wear old clothes, and all are forced to put back into the farm and home every cent that can be spared. Thrift is enforced, and thus, although constantly in debt and sometimes almost in want, the owner of a farm finds his holding increasing in value as the soil is intelligently tilled.

The individual counts for far more in these sparsely settled western states than in the east, and the farmers on these reclaimed lands may well feel a pride that they are a larger factor in the state and in the nation than they possibly could be in the densely crowded eastern section of the country.

F. H. NEWELL.

JOHNSON, CLIFTON. *Highways and byways of the Pacific Coast*. xiii and 323 pp.; ill. (American Highways and Byways Ser.) The Macmillan Co., New York, 1908; new edit., 1913. 8 x 5.

The author has "wandered much on rural byways and lodged most of the time at village hotels or in rustic houses" searching for "the typical and the picturesque." These qualities have been sought not only in the peculiarities of Pacific Coast scenery and climate but also, and most assiduously, in human types and in personalities. The first chapter, written in an informal and chatty style, gives interesting comments on the approaches to the Grand Canyon of Arizona and an accurate and charming word-picture of the soft tones of the successive strata and the wonderful changes of tints in the varying lights and shadows.

The reader must not expect to get a complete geographical account of any portion of the west, for the author's object is the enjoyment not merely of natural scenery but also of the reaction to a new environment of both settler and tramp. The itinerary carries one from Arizona to San Diego and southern California, thence northward through the San Joaquin Valley to the Yosemite and San Francisco, but the narrative is frequently interrupted by detailed accounts of trivialities touching human life. After a side trip to Nevada and the mines the journey continues northward again past Shasta to Oregon and the Northwest. Each chapter closes with notes for the traveler, and everywhere the author's camera has caught typical views which supplement the text.

RULIFF S. HOLWAY.

ABEL, A. H. *The journal of John Greiner*. *Old Santa Fe*, Vol. 3, 1916, No. 11, pp. 189-243. [Duties of a U. S. acting Superintendent of Indian Affairs at Santa Fe, New Mexico, in 1852.]

ATWOOD, W. W. *The physiographic conditions at Butte, Montana, and Bingham Canyon, Utah, when the copper ores in these districts were enriched*. Maps, diagrs., ill. *Econ. Geol.*, Vol. 11, 1916, No. 8, pp. 697-740.

AVERS, H. G., AND G. D. COWIE. *Precise leveling from Reno to Las Vegas, Nev., and from Tonopah Junction, Nev., to Laws, Cal.* 49 pp.; maps, diagr. *U. S. Coast and Geodetic Survey Serial No. 49*. Washington, D. C., 1916.

BRENNA, PAULO. *Interessi dell'emigrazione italiana negli Stati di Washington, Oregon, Idaho, e Montana*. *Boll. della Emigrazione*, Vol. 15, 1916, No. 7, pp. 5-42. R. Commissariato della Emigrazione, Rome.

DARTON, N. H. *Geology and underground water of Luna County, New Mexico*.

188 pp.; maps, diagrs., ills., index. *U. S. Geol. Survey Bull.* 618. Washington, D. C., 1916.

FREEMAN, O. W. **Geographic influences affecting distribution of population and character of industries in Montana.** 7 pp. Reprinted from *Inter-Mountain Educator*, January, 1916. [Abstracted in the *Review*, Vol. 1, 1916, p. 217.]

GARVER, F. H. **Montana as a field for historical research.** *Proc. Mississippi Valley Hist. Assoc. for the Year 1913-14*, Vol. 7, pp. 98-112. [Desiderata named include discussion of the geology, physical geography, early roads and trails, exploration, fur trade, mining, water and land transportation of the state.]

HULL, DOROTHY. **Castano de Sosa's expedition to New Mexico in 1590.** Ills. *Old Santa Fe*, Vol. 3, 1916, No. 12, pp. 307-332.

JUDSON, K. B., edit. **Dr. John McLoughlin's last letter to the Hudson's Bay Company, as chief factor, in charge at Fort Vancouver, 1845.** *Amer. Hist. Rev.*, Vol. 21, 1915, No. 1, pp. 104-134.

MC EWEN, G. F. **Summary and interpretation of the hydrographic observations made by the Scripps Institution for Biological Research of the University of California, 1908 to 1915.** Maps, diagrs. *Univ. of California Publs. in Zoology*, Vol. 15, 1916, No. 3, pp. 255-356. [Discusses the phenomenon of cold water along the Californian coast and the hypothesis of upwelling of deep cold water. For an abstract of an earlier article on the same subject by Dr. McEwen see note on "Ocean Temperatures along the West Coast of North America," *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 452-453.]

MEANY, E. S. **First American settlement on Puget Sound.** *Washington Hist. Quart.*, Vol. 7, 1916, No. 2, pp. 136-143.

MEINZER, O. E. **Artesian water for irrigation in Little Bitterroot Valley, Montana.** (Contributions to the Hydrology of the United States, 1916.) Maps, diagrs., ills. *U. S. Geol. Survey Water-Supply Paper* 400-B, pp. 9-37. Washington, D. C., 1916.

QUAIFE, M. M. **Notes and documents: Some new-found records of the Lewis and Clark Expedition.** *Mississippi Valley Hist. Rev.*, Vol. 2, 1915, No. 1, pp. 106-124.

RAMALEY, FRANCIS. **Dry grassland of a high mountain park in northern Colorado.** Ills. *Plant World*, Vol. 19, 1916, No. 9, pp. 249-270.

REED, W. G. **Report of the Meteorological Station at Berkeley, California, for the year ending June 30, 1915.** Diagrs. *Univ. of California Publs. in Geogr.*, Vol. 1, 1917, No. 10, pp. 441-504. [A note on the summer fog ascribes this phenomenon "probably" to mixture. Figure 6 is a clear and concise graphic presentation of the facts regarding the probability and the percentage of days with and without measurable precipitation. Figure 10 shows the precipitation of 1914-15 by rainfall days. A study of rainfalls by cyclones, a most important subject in our latitudes, is included.—R. DE C. W.]

— **Seattle, The public port utilities in.** 23 pp.; map, ills. *Port of Seattle Commission Bull. No. 8.* Seattle, [1916].

TERMAAT, M. I. **Cities of northern Puget Sound.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 368-369.

— **Washington number.** Maps. *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 309-372. [This series of articles on the physical geography, the resources, and development of Washington includes a paper of special interest entitled "Some Geographic Influences of Eastern Washington in Relation to Agriculture" by A. J. Lechner. The author points out that the variations in agriculture in various sections of the eastern portion of the state are very marked. He finds rainfall and soil to be the dominant controls, topography and altitude having secondary influences.]

EUROPE

GENERAL

EVERSLEY, LORD. **The partitions of Poland.** 328 pp.; maps, ills., index. Dodd, Mead and Company, New York, 1915. \$2.50. 9 x 5½.

NALKOWSKI, W. **Poland as a geographical entity.** With a preface by James Fairgrieve. 63 pp.; maps. Published for the Polish Information Committee by George Allen & Unwin Ltd., London, 1917. 8½ x 5½.

ORVIS, J. S. **A brief history of Poland.** xix and 359 pp.; maps, bibliogr., index. Houghton Mifflin Company, Boston, 1916. \$1.50. 8 x 5.

Sympathetic attention is directed at the present moment toward Poland in view of the promises of the restoration of the country's sovereignty made by both belligerent

parties. All three of these books offer information intended to enlighten readers on the historical basis of Poland's right to independence. From Lord Eversley's book it will be easy to understand how deeply Prussia was involved in the partition of Poland. Miss Orvis' work demonstrates the faulty side of the German pledge of November 5, 1916, granting Polish autonomy. This grant was made at Russia's sole expense and with the exclusion of Posen and Galicia. It therefore deprives Poland of the great cities which have been centers of national life for the last one thousand years.

For a clear description of the country Nalkowski's essay is of real value. It errs, however, on a side toward which Polish scientists have tended during the past two years with an ease altogether unwarranted by facts. A scientific delimitation of Poland's national area must primarily take into account the individuality of the Polish plain. The eastern boundary at the time of the First Partition or the widest extension of Polish frontiers beyond the Dnieper into Russia proper are mere records of military expansion. As such they are open to criticism analogous to that which is invoked to repudiate retention of German or Russian frontiers on Polish territory. The percentages of Polish population indicated on the map accompanying this work carry far greater significance.

OPPERMANN, EDMUND. *Europa (ohne Deutschland und Alpenländer)*. (Series: Präparationen für den geographischen Unterricht, Vol. 1). 362 pp.; ill., index. Julius Klinkhardt, Leipzig, 1913. Mk. 5.80. 10 x 6½.

This is a book written by a school inspector in Brunswick, not a doctor, not claiming to be a geographer, but a book that many a geographic doctor might envy for its simplicity and usefulness.

It contains the items most essential to be taught in school geography classes about most European countries. Germany and the Alpine countries are omitted. The material is good, fresh, and modern. Any teacher who has time would prepare his own material, but time is just what most of them have not. American teachers who are not well read on geographic literature, especially the German books, could not do better than use Oppermann until they come to know the original works. For he goes to admirable original sources, largely unknown in America, for his material. A clever introduction "to arouse interest" is usually prefixed and then follow classified materials, briefly stated, but not so barely as to be uninteresting. It is a very useful volume.

MARK JEFFERSON.

ANNONI, A. M. *Problemi demografici*. *L'Esplorazione Commerc.*, Vol. 31, 1916, No. 4, pp. 135-137.

CASSI, GELLIO. *La geografia come causa nell'attuale conflitto europeo*. *La Geogr.*, Vol. 4, 1916, No. 4-7, pp. 158-164. Novara.

— *Crops in the warring countries*. *The Nation*, No. 2663, Vol. 103, 1916, p. 29.

HARMS, PAUL. *Landmacht gegen Seemacht*. Map. *Berliner Tageblatt: Wochenausgabe*, No. 52, Vol. 4, 1915, pp. 1-2. [Abstracted under the title of "Land Versus Sea in the War" in the July, 1916, *Review*, pp. 63-64.]

HILDEBRANDSSON, H. H. *On the so-called change in European climate during historic times*. *Monthly Weather Rev.*, Vol. 44, 1916, No. 6, pp. 344-352. [Abstracted in the December, 1916, *Geogr. Rev.*, Vol. 2, p. 468.]

METHORST, H. W. *Etat de la population (Europe)*. viii and 166 pp. *Annuaire Internatl. de Statistique*, publié par l'Office Permanent de l'Institut International de Statistique. Van Stockum & Fils, La Haye, 1916.

NATALE, GIUSEPPE. *Sulla mancata espugnazione di Cattaro e dei Dardanelli, e sulla necessità, per l'Italia, di possedere parte della costa orientale adriatica*. *Diagrs. Riv. Militare Italiana*, Vol. 61, 1916, No. 7, pp. 854-866.

NAUMANN, FRIEDRICH. *Central Europe*. Translated by Christabel M. Meredith, with an introduction by W. J. Ashley. xix and 354 pp.; bibliogr., index. P. S. King & Son, Ltd., London, 1916. 7s. 6d. 9 x 6. [Mainly politico-economic.]

RIDSDALE, P. S. *Shot, shell and soldiers devastate forests*. Ills. *Amer. Forestry*, No. 270, Vol. 22, 1916, pp. 333-340. [On the devastation of forests in the European war zone.]

DARDANO, ACHILLE, AND L. F. DE MAGISTRIS, eds. *Atlante della nostra guerra*. 60 pages of text (illustrated) and 16 maps. Istituto Geografico de Agostini, Novara, 1916. [An excellent atlas containing political, topographic, and ethnographic maps dealing with the European War, with special emphasis on the Austro-Italian boundary region. This section is shown topographically on six maps in 1:250,000, with altitude tints, re-

prints of the admirable map published by the Italian Touring Club. A critical feature of the large-scale ethnographic map of the Trentino (Pl. 8) is the omission of racial coloring from the mountain heights, the valleys, as the only inhabited lands in this region, alone being colored. The German area, usually indicated as an uninterrupted mass north of the Ötztal-Dolomite Alps axis, thus dwindles to the strips representing the upper Etsch and Eisack valleys, the Pustertal and the Passeiertal. The "natural geographical boundary" of Italy is shown on the appropriate maps.]

— [*France, Northeast, and southwest Belgium, map showing battle front, and described as "Map of the British Battle Front": no title on map.*] 1 in. to 4 mi. (1:253,440). G. W. Bacon & Co., London, 1916.

AFRICA

GENERAL

RECLUS, ONÉSIME, edit. **Grande Géographie Bong illustrée: Les pays et les peuples: Vol. 4 [Africa].** 406 pp.; maps, diagrs., ills. PAUL PELET: *Afrique du Nord (Algérie, Tunisie, Maroc)*, pp. 3-74; HENRI BUSSON: *L'Ouest Africain*, pp. 77-156; A. CABATON: *Le Nord-Est Africain*, pp. 159-226; M. CHESNEAU: *Afrique Australe*, pp. 229-322; HENRI FROIDEVAUX: *Les îles africaines de la Mer des Indes*, pp. 325-342; HENRI FROIDEVAUX: *Les terres du Pacifique*, pp. 345-397. Bong & Cie, Paris, 1914. 15 x 12.

This volume is one of five large volumes describing the countries and peoples of the earth, produced under the direction of Onésime Reclus. Africa occupies seven-eighths of the book, and very summary treatment is given to the "Pacific lands," under which term are included Australasia and Oceania and the Philippines. The authors are well known as writers on geography.

The book is a sumptuous product. Its illustrations, halftones, and plates in colors are numerous and educative. Every photograph tells something worth knowing. The maps are in the best style of French cartography. There are 15 large maps in colors and 100 maps and plans in the text. The majority of the large maps are in physical coloring with hachures; being on scales larger than usually available in this important manner of representation (most of Africa 1:8,000,000, Atlas countries, 1:2,500,000), they are especially valuable. Many of the text-maps are black-and-white insets that show surface forms most effectively.

The narrative is permeated with scientific spirit and good geography that is adapted to the needs of any intelligent reader. But we miss a chapter giving a general treatment of the continent. Coast lines and their significance are treated by countries; but what is the effect upon Africa of the fact that, while it is nearly three times as large as Europe, it has only 19,000 miles of coast line, while Europe has 23,000? Surely a book on Africa should make it clear that the continent is less approachable from the sea than any other excepting Antarctica; and we also miss other broad characterizations of Africa as a whole that really have vital relation to the description of parts of it.

The book deals with the face of Africa as it now appears. It would interest many to be told something about how we are able to draw so complete a picture. Take the Niger River, known vaguely to the ancients before the Christian era. A hundred and one years ago last July Captain Tuckey and twelve of his men died of fever on the banks of the Congo, believing that they were on the lower Niger; and geographers, for years after, supposed this was true. A few lines would tell why there was a Niger problem and how it was solved. The book mentions the "Niger problem" and says Clapperton solved it; but it was Lander who threaded the delta, reached the sea, and received the first award of the Royal Medal of the Royal Geographical Society for solving the Niger problem.

Another incident may be mentioned here, not in criticism, but to show what interesting side lights may be thrown upon the Africa of today by a casual appeal to history. While the "Island of Meroë" appears on the maps, it is not mentioned in the text of this book. This name commemorates an interesting discovery made by the Greeks before the time of Christ. The Greeks said there was an enormous area of land in Africa that was entirely surrounded by water. This was almost but not quite true. We can easily trace their "island" on a map. Start at Lake Tana in Abyssinia. Follow the Blue Nile, which emerges from the lake, south and west to the White Nile; follow the White Nile north to the Atbara River; then follow the Atbara to its source, which a good map will show a little to the northwest of Lake Tana; and also a tiny tributary of the lake that rises only two or three miles from the Atbara. Nature did not quite complete the island.

The book most admirably performs its task of showing the various countries and

their peoples, especially in their utilitarian aspects as we know them today. There is, of course, an occasional statement that might be improved. In treating the *sudd* in the Upper Nile as a great obstruction to navigation the book fails to mention another serious evil that the barrage inflicts. An enormous quantity of water, held up by this obstruction, evaporates, while Egypt needs every drop she can get not only for irrigation but also for the manufacturing enterprises which it is hoped to establish. British engineers were planning before the war to open and maintain an uninterrupted channel.

The interest of the French in Africa accounts for the space devoted to that continent. Nevertheless the allotment of 30 pages to Australia and New Zealand as compared with 350 to Africa seems somewhat out of proportion. However, in this brief space, the essentials of Australasian geography are brought out. The reason given (p. 389) for the inclusion of the Philippines in Australasia is flimsy.

CYRUS C. ADAMS.

HUFFNAGEL, G. E. **Trans-Afrikaansche spoorwegproblemen.** Maps. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 9, pp. 441-448; No. 10, pp. 471-478.

JOHNSTON, H. H. **The Portuguese and their early knowledge of central African geography.** *Geogr. Journ.*, Vol. 47, 1916, No. 3, pp. 210-212.

MARTEL, E. A. **Les colonies portugaises.** Maps, ill. *La Nature*, No. 2230, 1916, June 24, pp. 401-406.

NICOLA, ANGELO. **L'Italia ed il futuro equilibrio africano.** Maps. *L'Esplorazione Comm.*, Vol. 31, 1916, No. 3, pp. 81-91; No. 4, pp. 126-135.

O'LEARY, DELACY. **Characteristics of the Hamitic languages.** 46 pp.; bibliogr. John Wright & Sons, Ltd., Bristol, 1915(?). 7½ x 5.

PHYSICAL GEOGRAPHY

GEOLOGY AND GEOMORPHOLOGY

DARTON, N. H. **Explosion craters.** Maps, diagrs., ill. *Scientific Monthly*, Vol. 3, 1916, No. 5, pp. 417-430.

Explosion craters are holes of volcanic origin occurring on plains instead of on volcanic peaks. They have no connection with lava outflows but are rimmed with fragmental volcanic material. A study is here made of the group of such craters near Orizaba Peak, not far from the city of Mexico, of several in north-western Sonora near the international boundary, and of some in Arizona. Among the latter is Crater Mound, or Coon Butte, as it was formerly named, called by the author one of the greatest enigmas in nature. The idea has been advanced that it was caused by the impact of a mass of meteoric iron from 50 to 100 feet in diameter, but this view has not yet been substantiated by evidence of the rocks or by a local study of the magnetic declination. Without expressing an opinion as to this hypothesis Mr. Darton points out the similarity of this crater to others of undoubtedly explosive origin, including not only those in Mexico and the southwestern United States, but also those in the valley of the Rhine, in France, Italy, Madagascar, and India. A photograph of a crater 50 feet deep made by the explosion of a mine in northern France during the present war shows a remarkable resemblance to Crater Mound. Numerous contour maps and sections show the typical steep inner and gradual outer slopes of the craters, breaking through old beds which are bent up very slightly or not at all, with rims formed of the ejected material. The rims are deposited on ancient lava flows or on sedimentaries, fragments of which are included in the ejecta. Ordoñez is quoted with reference to the Mexican craters. He regarded them as marking the last stages of volcanic activity and the product of igneous action of comparatively slight depth.

R. H. JONES.

PHILIPPSON, ALFRED. **Die Erosion des fließenden Wassers und ihr Einfluss auf die Landschaftstypen.** 36 pp.; diagrs. *Geogr. Bausteine* No. 7. Justus Perthes, Gotha, 1914.

Philippson's essay gives the subject-matter of three public lectures under the above title, and opens with an historical review of the growth of geomorphology. The modern development of the subject, in the author's opinion, has been unfavorably affected by what he considers the undue emphasis on the deductive method and the extreme attempts at classification, involving highly specialized nomenclature, introduced by Davis. There follows a general discussion of the principles of stream action upon different types of land forms and under different climatic conditions, along lines already quite familiar to American students. The essay is illustrated by numerous simple diagrams, and furnishes a good elementary discussion of a subject on which the author is eminently qualified to speak.

DOUGLAS W. JOHNSON.

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AËRONAUTICAL MAPS AND AËRIAL TRANSPORTATION

By HENRY WOODHOUSE

Editor of *Flying*

Maps have always been most important factors in military and naval operations, just as they have been important factors in peaceful travel over land and water. To the aviator the map is as important as to the navigator at sea; and just as the mariner's chart must tell the navigator of currents, depths of the water, and locations of rocks and reefs, so the aëronautical map must tell the aviator of the character of the land and the configuration of the bodies of water below. It must show the land as it is, the exact shape of cities, woods, and lakes; the course of rivers, railroads, and roads; it must indicate clearly the prominent landmarks and the established aërodromes and open fields suitable for landings, etc. In short, the aëronautical map must show the land as nearly as possible as it looks to the aviator from the air.

FOUR TYPES OF AËRONAUTICAL MAPS

The more important aëronautical maps in current use, especially in the present war, may be divided into four types. These, with the leading representatives of each type, are as follows:

(1) *General aëronautical maps.* These are maps that have already been in existence for some time but are on a scale suitable for aviation, say three or four miles to the inch. They are usually based on the larger-scale topographic sheets. Such a map is the *Carte de France* on the scale of 1:200,000 in 86 sheets published by the *Service Géographique de l'Armée*. On it roads are shown in red, railroads in black, forests and woods in green, and waterways in blue.

(2) *Special aëronautical maps.* These are maps that have been prepared primarily for aviation. They represent the usual map elements in a bold and striking way, stressing the features of importance to the aviator.



FIG. 1.—A section of the Paris sheet of the aeronautical map of France, 1:200,000, published by the Service Géographique de l'Armée. In maps of this type the usual elements are represented in a bold and striking way, the features of importance to the aviator being emphasized. Thus they have special symbols for aerodromes and landing fields and for such landmarks as prominent churches, factory chimneys, windmills, castles, and monuments.



FIG. 2—A section of the Paris sheet of the aéronautical map of France, 1:200,000, published by the Aéro-Club de France. This section embraces exactly the same area, and on the same scale, as the figure above. The symbols are similar in type.

In addition they show aërodromes for aëroplanes and dirigibles; landing fields, when there are no hangars; stations where gas for dirigibles is obtainable; the approximate shape of cities, towns, and villages, and such landmarks as prominent churches, railroad stations, windmills, smokestacks, castles, and monuments. The two foremost maps of this type (see Figs. 1 and 2) are the *Carte Aéronautique de la France*¹ on the scale of 1:200,000 published by the Service Géographique de l'Armée since 1911 (at least four sheets issued before the war) and the *Carte de France* on the same scale published by the Aéro-Club de France since 1911 (at least thirteen sheets, covering the northeastern frontier, issued). A new and revised edition of this map is in course of publication.²

These maps are used for long-distance flights and raids. When a flight is planned, the aviators go over the map, lay down the route to be followed, and study the details given on the map, together with any other information that they may be able to get regarding the configuration of the land over which they will fly, the possible landing places, etc. Needless to add, the aviators make every effort to ascertain as closely as possible the nature of the enemy country in order to be sure to recognize places where bombs are to be dropped, as well as places where anti-aircraft guns are most likely to be waiting.

(3) *Special aëronautical maps for permanent aërial routes.* These give the information required by an aviator only for a strip of territory along a given route. This type of map originated in Italy and has not yet been put into general use outside of that country. The example reproduced herewith (Fig. 3) represents the first lap of an air route traversing the length of the Po Valley from Turin to Pordenone. The distinctive feature of this map is the treatment of the air route and its landing places. The route itself, a permanent one, is indicated as a red dotted line. The aërodromes are shown as red rings; the landing places which permit landing from two sides are shown as two red dots of the same size connected by a red line; the landing places which permit landing from one side only are indicated by two red dots of unequal size connected by a short line. The large dot represents the approximate place where the wheels of the aëroplane must touch on landing. The line that connects it with the smaller dot shows the direction toward which the aëroplane must run in landing. The distance between the first dot and the second is usually about 300 meters, and the width is usually about 100 meters.

This type of map greatly facilitates aërial navigation. An American map of this kind is the Sperry aëronautical map, which was described in the July, 1917, *Review*.³ It was evolved independently of the Italian map

¹ Cf. P. Pollachi: *La Carte Aéronautique du Service Géographique de l'Armée*, *Ann. de Géogr.*, Vol. 20, 1911, pp. 311-315.

² La "Carte-Avion": Nouvelle carte aéronautique de l'Aéro-Club de France, *l'Aérophile*, Feb. 1-15, 1917, pp. 68-69.

³ O. B. Whitaker: *Aëronautical Charts*, *Geogr. Rev.*, Vol. 4, 1917, pp. 1-5; reference on pp. 2-4.

and has several improvements over the latter. In this series maps of the air routes between New York and Chicago, New York and Newport News, Va., and of Long Island, have already been prepared. In addition to the topographical information they carry, it is planned to show aërodromes (these are being established partly by the Army Air Service and partly by civil organizations); prominent landmarks; and the landing places for twenty-five to fifty miles on either side of the route. Each leg of the route is marked with its magnetic bearing, both coming and going, and compass roses showing the magnetic variation in a given district are added at frequent intervals. The bearing from one city to another is determined by projecting the line of flight between those two cities and then transferring this line by means of parallel rulers to the nearest compass rose. As all the bearings are magnetic, the pilot simply steers his craft according to the charted reading.

A map is also being prepared of the air-line, or great circle, route between New York and San Francisco, which would make it possible for any aviator to fly across the continent without losing his way. The Aero Club of America proposed to call this route the Woodrow Wilson Aërial Highway.

The air route is shown in a red dotted line (the line leading from Turin via Novara to Milan and beyond), aërodromes in red rings, and landing places by two dumbbell-shaped symbols with circles of equal or unequal size depending on whether the landing can be effected from two sides or from one side only.

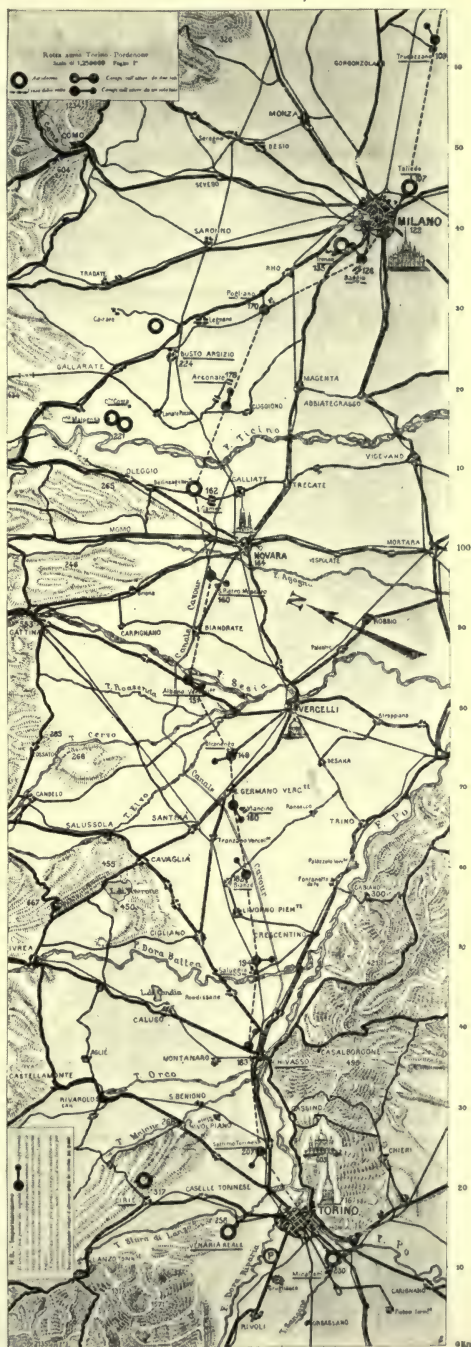


FIG. 3—Reduced photograph of the first sheet of an Italian air route map, 1:250,000, of the Po Valley from Turin to Pordenone. (Continued on the left.)

and, President Wilson having expressed his approval, work has been started to outline the route in detail and establish the landing places along the route. The map will not only show the narrow strip along its course, but will include lines leading from the main line to central landing places like Erie, Cleveland, and Detroit. The general course of the Wilson Highway is shown on Figure 4.

As soon as regular air lines are established to carry passengers and mail and aircraft start from a given station at a given time daily, it will be possible to insert on this type of map the approximate time at which the aircraft must pass certain places, so that the aviator will be able to navigate the air with even less trouble than the mariner navigates the sea. In fact, an aëroplane equipped with the Sperry automatic pilot could be set to follow the compass direction in trips of a few hundred miles, and thereafter the pilot would have practically nothing to do, as the automatic pilot would control his machine completely. The pilot would only have to guard against the drift due to side winds, which he would do by occasionally comparing his map with the ground below and setting his course right if necessary. Otherwise, finding out his whereabouts would be easy. Knowing the speed of his machine and the approximate time required to reach different places, he could determine by a glance at the watch at what point he should be at that hour.

(4) *Photographic maps.* It is on maps of this type that the military operations on the present battle fronts are based. In the conduct of these operations photographic maps are essential. They are re-made daily, often several times a day, to include the changes shown by the photographs taken by the aviators from their aëroplanes. These photographic maps show the configuration in the most minute details, and with the utmost care, as the success of certain operations depends upon the exactness of the smallest topographical details.

Aërial photography is now almost an exact science. The aviator from a height of 6,000 to 8,000 feet can take a photograph which will include and show clearly the whole of Manhattan Island; and the photograph can be enlarged to show the main streets, docks, bridges, and buildings. A series of photographs can be taken from New York to Albany which can be combined to form a continuous map of the entire route and show every detail to scale—such a map as could not be made by any other method even with the expenditure of years of time and large sums of money. Or the aviator, flying at what is considered a slow rate for an aëroplane, about 70 miles an hour, can take a motion picture of the entire route, giving the exact topographical conditions. This would permit the military authorities within twenty-four hours to conduct operations with certain knowledge as to the conditions between Albany and New York. Ultimately, it may be possible to add on the margins of the printed route maps the photographic map of the corresponding strip of territory, and thus make the reading of the map and the identification of the terrain a matter of no difficulty whatever.

AN ABANDONED INTERNATIONAL CONVENTION ON AÉRONAUTICAL CARTOGRAPHY

The war prevented the holding of an international convention which was to discuss and decide on the basic principles for an aëronautical map of the world. This convention was being arranged in the United States by the Aero Club of America at the suggestion of Rear Admiral Robert E. Peary, Chairman of the Committee on Aëronautical Maps and Landing Places of the Aero Club of America. Admiral Peary attended the Tenth International Geographical Congress, held at Rome in March and April, 1913, at which the subject of aëronautical maps was discussed. The report of this congress and the principal address delivered were translated from the Italian by the writer and printed in *Flying*, the organ of the Aero Club of America, for September and October, 1913.⁴

At this congress no decision was reached or action taken towards adopting basic principles for the making of aëronautical maps, because it was recognized by the delegates, as it had been recognized by the delegates that attended the Congress of the International Aëronautic Federation at Vienna in June, 1912, that the first step to be taken should be an agreement on a scale and the conventional signs to be adopted. The aëronautical map of the world was then to be supplemented by aëronautical maps of different countries, and of parts of different countries, made on the accepted scale and with the use of the same conventional signs.

It was to bring about this international agreement that the Aero Club of America was arranging to hold an international convention in the United States, the object being to do for the world aëronautical map what was done for the international map of the world by the International Geographical Congress at Geneva in 1908. The necessary arrangements were to be made, through diplomatic channels or otherwise, to facilitate the execution of the sheets of this map overlapping the frontiers of different countries. Although the war prevented the holding of this convention, the Committee on Aëronautical Maps and Landing Places of the Aero Club of America continued its work to advance the project.

The purpose of this committee, stated in April, 1914, was as follows:

(1) To bring about an understanding between the sporting, military, and scientific authorities of different countries; and also an agreement to use uniform scales and conventional signs in making aëronautical maps.

(2) To make an aëronautical map of the United States and of the central parts of South and Central America and Canada; and to do this with the co-operation of aëro clubs affiliated with the Aero Club of America, and of aëro clubs of South and Central America and Canada.

(3) To urge the establishment of a chain of aërodromes for landing aëroplanes and landing stations for flying boats and hydro-aëroplanes, so that

⁴ Giovanni Roncagli (translated by Henry Woodhouse): *To Make an Aëronautical Map of the World*, *Flying*, Vol. 2, 1913, No. 8, pp. 16-17 and 24, No. 9, pp. 8-9 and 30.

aviators who wish to make long flights over water or land may not be handicapped by the lack of landing places, as they are now. One of the reasons why France, Germany, and Italy have more flying than we have, is that



FIG. 5—A part of the Latin Quarter of Paris photographed from an aëroplane. The prominent building in the lower left of the picture is the Pantheon; in the right center the group of buildings surrounding a large courtyard belong to the Ecole Polytechnique. (Photo copyright by Underwood & Underwood.)

This photograph strikingly illustrates the value of photographic mapping from an aëroplane. When the view is taken vertically downwards, as in this case, the photograph is practically equivalent to a map; when the view is taken obliquely, as in Figs. 8 and 9, the photograph can easily be reduced to the ground-plan form of a map by an optical apparatus designed for this purpose. In either case the method is far more rapid and comprehensive, and less laborious and expensive, than the methods of surveying usually employed heretofore.

there are special landing places for aviators near all the cities and central towns. France alone has over three hundred landing places where aëronauts can get supplies and keep their machines over night.

(4) To encourage long-distance flying by chart and compass, as is now



FIG. 6—The San Diego, Cal., Exposition of 1915-16, photographed from a flying boat. (Photo copyright by Harold A. Taylor, Coronado.)

done in Europe. In Europe there are over 7,000 licensed aviators, and not less than 100,000 flights with passengers are made each month. In America there are only about 300 licensed aviators, and only a few hundred passengers are carried in flight each month. The distance record across country without stopping is 750 miles in Europe and only 220 miles in America; the duration record is 18 hours 10 minutes in Europe and only 6 hours 10 minutes in America. Lack of inducement alone accounts for our backwardness.

AËRO CLUBS AS PROMOTERS OF THE EXISTING AËRONAUTICAL MAPS

Existing aëronautical maps are mainly the result of the work of the aëro clubs of France, Italy, and the United States. The same pioneer sportsmen and volunteers who were responsible for developing aëronautics in the different countries up to the time of the war were also responsible for the first aëronautical maps. The writer well remembers how these pioneers, who are now considered as pioneers and authorities in aëronautics and are given credit for having had "wonderful foresight" at that time, in the years from 1910 to 1914 were considered visionaries. Few people were willing to admit that aircraft within fifty or a hundred years would develop to such a point that aëronautical maps would be needed for their navigation. But these pioneers went on with their work.

In 1910 officials of the Automobile Club of America and the Aero Club of America combined efforts in making a topographical map of western Long Island for aëronautical purposes. This map gave the main routes, inhabited places, and landing fields suitable for landing aëroplanes. It was very creditable work for a time when a cross-country aëroplane flight of 25 or 50 miles was still considered an extraordinary event.

The aëronautical map published by the Aëro-Club de France has already been mentioned. The sheets already issued are used extensively by the French and British Flying Corps. M. Charles Lallemand, the well-known French scientist, is the chairman of the Aëronautic Maps Committee of the Aëro-Club de France.

In Italy the work of making the aëronautical maps has been shared by the aëronautical authorities, the authorities of the Touring Club of Italy, and the members of the National Commission of Aërial Touring. The Italian pioneers in aëronautical topography include Senator G. Celoria, the chairman of the National Commission on Aërial Touring; Commander Giovanni Roncagli of the Royal Italian Navy; Signor C. Uselli, and other well-known Italian scientists. The pioneer work of these organizations was of great value to the military authorities of their respective countries in the present war. In France and Italy the aëro clubs were practically the only sources where the necessary information about aëronautical maps could be found, as little attention had been paid to this subject by the military authorities.

AN INTERNATIONAL COMMISSION TO FOSTER THE MAKING OF A WORLD AÉRONAUTICAL MAP

Fostering the plans to make a world aéronautical map will be one of the purposes of the International Commission on Civil Aéronautics which is being organized under the auspices of the Aero Club of America, the Aërial League of America, and the Pan-American Aéronautic Federation. The membership of this Commission will include representatives of official bodies and national and international organizations interested in aéronautics of all the Allied and Pan-American countries. Officers of two of these organizations have already gone to France and while in Europe will collect data and study the plans of the Allied countries regarding aërial transportation and aéronautical maps and will arrange for the co-operation with the International Commission of aéronautical bodies and of official and scientific bodies interested in aéronautics.

RECENT COMMISSIONS ON CIVIL AÉRONAUTICS

On January 6, 1917, a French Commission of Civil Aéronautics was created by ministerial decree to study the possibilities of using aircraft for the transportation of mail and for other commercial purposes. The first meeting of this commission was held on January 30, 1917, at the Bureau of Commerce, Industries, Agriculture, Labor, and Post Offices and Telegraphs.

The membership of the Commission includes representatives of the Chamber of Deputies, the Bureau of Post Offices and Telegraphs, the Aéro-Club de France, the Chambre Syndicale des Industries Aéronautiques, and the Aërial League of France. The meeting was opened with the statement that French genius had developed aéronautics to serve the cause of civilization, but that Germany had forced France to convert aircraft into instruments of war, and that it was not too soon now to look forward to the time when, after having defeated Germany, aircraft could be used extensively as instruments of peace for transportation and for developing closer international relations. Those present were urged to look into the future and see how far the employment of aircraft could be extended. This commission is now studying the subject.

On May 23, there was announced in the British House of Commons the creation of the Civil Aërial Transport Committee, to study the possibilities of the application of aircraft to commercial purposes. This committee includes representatives of the British Air Board, the Royal Aero Club, the Government of India, the Royal Flying Corps, the Royal Naval Air Service, the Colonial Office, the Foreign Office, the Post Office, the Treasury and Board of Customs, and the Meteorological Office. Its purpose, as stated in the House of Commons by Major Bair, secretary of the British Air Board and deputy chairman of the committee, is as follows:

To consider and report to the Air Board with regard to: (1) the steps which should



FIG. 7.



FIG. 8.

FIG. 7—A Curtiss biplane and a Curtiss flying boat flying along the Florida coast. (Photo by Goodrich, Miami, Fla.).

FIG. 8—Northern end of Miami, Florida, from an aeroplane, looking across the head of Biscayne Bay to the ocean beyond. (Photo by R. B. Hoit.)

be taken with a view to the development and regulation, after the war, of aviation for civil and commercial purposes, from a domestic and Imperial and an international stand-



FIG. 9—The French Settlement at Tientsin, China, from an *aéroplane*. (Photo by René Caudron.)

point. (2) The extent to which it will be possible to utilize for the above purposes the trained personnel and the aircraft that the conclusion of peace may leave over and above the requirements of the naval and military air services of the United Kingdom and the overseas dominions.

The proceedings of the committee, to a large extent, will have to be confidential. The committee, I would remind the honorable members, corresponds to a similar body which has been already created in France under the presidency of M. d'Aubigny. It was set up by the Ministry of Commerce and was appointed to consider the routes to be followed in France, the Colonies, and in Allied countries, types of machines to be employed, types of postal car or carrier, bases, relay stations, and the recruitment of the personnel as

well as the question of the purchase of hangars, *aéroplanes*, motors, etc., for the military authorities.

LORD MONTAGU'S WORLD AIR ROUTES AND THEIR REGULATION

Colonel Lord Montagu of Beaulieu, Advising Mechanical Inspector to the Government of India, who has been one of the strongest supporters of the movement to develop the British *aërial* forces, on June 21, 1917, gave in a lecture at Central Hall, Westminster, on the world's air routes and their regulations, a very interesting forecast of the future of the *aéroplane* in relation to international commerce.

He pointed out that there is a chain of British *aëronautical* landing places southward and eastward from Gibraltar about 900 miles from London as the plane flies towards the Cape to Egypt, India, and Australasia.

Lord Montagu brought out many interesting points, including the following:

- (1) As soon as the war is over there must be national and international laws for the regulation of flying.

- (2) Oversea and over-continent routes must be defined in the interests of the whole world.
- (3) The winds of the world, instead of being a drawback to flying over the surface of the planet, will, if properly used, prove to be of great assistance.

Dealing with the separation of traffic in "levels," Lord Montagu said:

Now we come to the point at which we must inquire how flying round the world is to be regulated; how the principal lines of traffic are to be defined; the methods of constructing the principal aërodromes, which I will call "dromes" for short; the land-

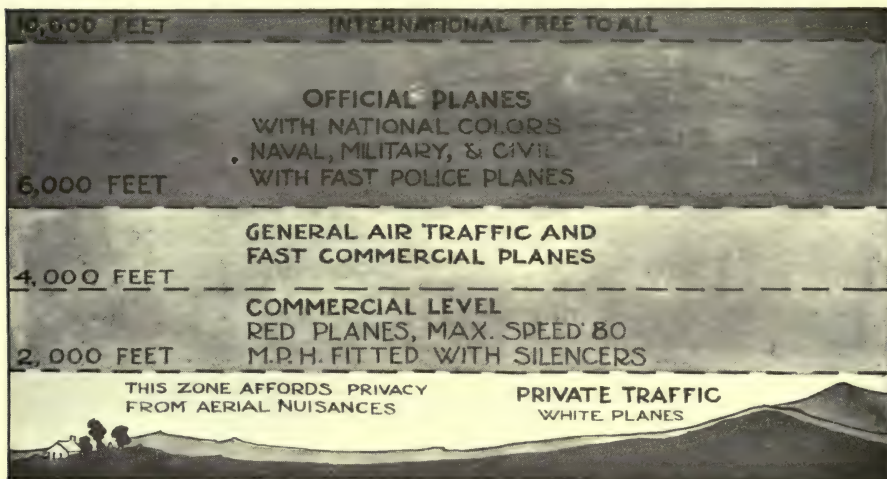


FIG. 10—Sketch showing Lord Montagu's conception of the conditions to govern aërial traffic in the near future, involving the establishment of various levels in the air. (Based on a copyright drawing in the *London Graphic* of July 7, 1917.)

ing places for safety purposes. In considering these problems, it must be remembered that we have the third dimension to help us, that is, height and depth as well as length and breadth. Air traffic will present features similar to those on both land and sea in addition to marked new possibilities peculiar to the air.

The general principle which I think should underlie all regulation of air traffic is that slow-speed planes should use the lower levels and high-speed planes the upper levels of the air. I suggest five levels, stretching from the earth's surface up to 10,000 feet, through which the various kinds of traffic should be classified to pass. The first 2,000 feet from the surface of the ground upwards should be prohibited to air traffic in general, but be usable, of course, by the private owner of the soil if he desires, and for the purposes of descending to his own landing or to "dromes" or intermediate safety landing places. This must be so, for aëroplanes will probably form one of our commonest means of locomotion in a few years' time, and provision must be made for all traffic to land at intervals of, say, 10 or 15 miles on defined routes.

In admitting the claims that any air should be private, I conform, to some extent, to the present law of *usque ad coelum*, but I propose to limit that right to an altitude of 2,000 feet. Owners of houses and land, and the dwellers upon and in them, have a moral and probably a valid legal claim to be secured some privacy from nuisances arising from air traffic. Apart from noise, there may be the danger of voluntary or invol-



FIG. 11—Pictorial summary of proposed traffic provisions along a commercial air route, according to Lord Montagu. (Based on a copyright drawing in the *London Graphic* of July 7, 1917.)

untary descents. When flying becomes general everywhere, without some such regulation no privacy will exist for anyone except in lonely lands or dense forests.

Above this private level we come to the commercial levels, which I propose shall range from 2,000 feet to 4,000 feet. I place this class of traffic on the lowest of the flying levels, on account of the fact that commerce will want to operate as cheaply as possible, and to achieve height and speed means extra expenditure of motor spirit, whichever way it is looked at. And I would make this 2,000 to 4,000 feet level usable by silenced planes only with a maximum speed of 80 miles an hour.

Above these commercial levels I propose another zone of 2,000 feet, 4,000 feet to 6,000 feet for planes, also silenced, capable of speeds between 80 and 120 miles per hour. This will include the general air traffic of the planet for ordinary flying, including a proportion of fast commercial flying. As all aëroplanes will shortly be fitted with superchargers, or their engines designed and built for high altitudes, high flying will become quite easy. At present the decreasing density of the air at high altitude, leading to falling off in engine power, is a disadvantage. This will shortly be neutralized so that the engine produces the same or even greater power at a height than at the earth's surface. This is, of course, a height where human health and comfort will be affected owing to the effects on the blood of decreased atmospheric pressure, such as what is called "fizzing," and the chance of faintness and heart attacks when a rapid descent takes place. The intense cold also at high altitudes will tend to keep passenger traffic, as a rule, in the lower levels, for there is a decrease of about 5° Fahrenheit for every 1,000 feet of height.

Above 6,000 feet to 10,000 feet I would reserve the levels for the official planes of each nation. These levels would be used by its naval, military, and civil forces, and by police planes, for air police will be needed in the same way that policing of routes by land and sea is now necessary. Specially authorized pilots, and perhaps postal services, will also use the 6,000 to the 10,000 feet levels, where the international levels will begin. I would remark here that unless we are to have lawlessness and anarchy in the regions of the air there must be efficient control—this is an axiom of efficiency and civilization. Control of the levels can only be exercised, nationally and internationally, by police pilots on fast planes above ordinary traffic, where, with the forces of gravity to aid, they can descend with a superior swiftness upon malefactors and breakers of the law of the air, take their numbers, or compel them to alight at the nearest landing place or drome. There must also be no unsilenced machines regularly operating below 8,000 feet—I am not sure whether that limit is high enough—for even above that height the noise of many open exhausts and the hum of many propellers may become a continuous and nerve-racking nuisance. A serious amount of unpopularity and agitation against the use of unsilenced planes will have to be faced before long.

Now we come to the levels above 10,000 feet, which I propose should be internationalized. The upper air should, I think, be free to all, under certain regulations, provided pilots comply with certain rules for meeting and overtaking and their craft passed as air-worthy—let us say, registered as A1 in a Lloyd's aërial register. This would follow the precedent, which has worked well, of the three-mile limit at sea open to all ships of all nations. Great altitudes will impose upon ordinary flying some disadvantages which will tend to keep international flying over land and over sea near the 10,000-feet limit, and flying at these levels will probably, so far as international flying is concerned, be conducted along routes to be defined by methods to which I will allude presently, and in some cases nations may agree to admit international traffic to its own levels. But if a particularly cantankerous nation objects to admit any traffic to the lower levels below 10,000 feet, the air routes will not be altogether barred. It is clear, also that there will be prohibited areas, naval and military centers, and flying over thickly populated districts will probably be avoided on account of a certain risk to those who are still content to crawl about on the earth. But, of course, this will not preclude, as I



FIG. 12—Sketch showing the use of a map on an air journey. The aéroplane is represented as approaching Washington, D. C. The map, printed on a long strip, is mounted in a holder which passes over two rollers, which can be turned so as to bring before the aviator the locality above which he is flying. (Drawing by N. E. Jennett.)

have said, the air liners of different countries using the lower levels when necessary under license from the countries over which they pass. Then, postal and passenger services may sometimes be driven down to lower levels owing to stress of weather.

Aircraft desiring to leave their own levels will, of course, use their wireless to ask permission from national or international flying authorities. But in this case they should conform, at least so I think, to the rules for silence and any other restrictions which may be found necessary in the lower levels to ensure the peaceful enjoyment of the earth's surface by its inhabitants. The problem of how to secure law and order on oversea routes is more difficult, and for this purpose it seems to me that we shall eventually have to define the paths to be followed within, say, certain degrees of latitude and longitude. It is here again that international control will be necessary, and this control must be backed by international force in the shape of air police, for without force behind them conventions and international arrangements are as futile as the resolutions of the Hague Convention have proved to be. It may be, therefore, that flying over the sea outside the three-mile limit will become a question of routes outward and homeward with no exactly defined air levels or a fewer number of levels, for there are no inhabitants to annoy over the wide spaces of the ocean, and no one to kill or annoy, barring the very remote risk to those few human beings who will still be navigating the sea in ships, probably submersibles by then.

COLONEL O'GORMAN'S PLANS FOR EMPLOYMENT OF AIRCRAFT IN TRANSPORTATION

Lieutenant Colonel Mervin O'Gorman, C.V., late Superintendent of the Royal Aircraft Factory, delivered a very able paper at the Grafton Galleries, London, on June 13, 1917, in which he outlined the possible use of aircraft for commercial purposes. Only a synopsis of his paper can here be given.

Colonel O'Gorman divided commercial aëronautics into three parts, as follows: (1) the home, or internal aspect; (2) the foreign, or international aspect; (3) the Imperial and Colonial aspect. He outlined the possible use of aircraft for transportation and some of the questions to be considered in connection with internal British aëronautics as follows:

(1) The uses of aircraft.

- (a) Transit of goods.
- (b) Transit of letters.
- (c) Transit of persons.
- (d) Labor of transit service.
- (e) Finance of transaërial companies.
- (f) Government subvention of aërial transport.
- (g) Private, sporting, and domestic use.
- (h) Scientific use, surveys, etc.

(2) The safety provision.

- (a) Aërial routes and lines of landing grounds; maps.
- (b) Night flying and landing.
- (c) Aërology and meteorology.
- (d) Wireless communication of distress, orders, and signals of directions.
- (e) Labor of ground upkeep, etc.
- (f) Subvention of safety precautions and grounds.
- (g) Accidents, investigation.
- (h) Keeping of records.
- (i) Insurance of (1) pilots; (2) passengers; (3) craft.

- (3) Education of personnel.
 - (a) Designers and engineers.
 - (b) Fliers and navigators.
 - (c) Military call on fliers.
 - (d) Polytechnic and correspondence schools for labor.
 - (e) Subvention of education.
 - (f) Collation of data, research.
 - (g) Inventions.
 - (h) Consular trade information, etc.
- (4) Production of aircraft.
 - (a) Best employment of existing factory organization.
 - (b) Finance and subsidies to makers.
 - (c) Military and naval requirements.
 - (d) Publicity and "load curve orders."
 - (e) Utilization of overplus of military and naval war orders.
 - (f) Supply of aircraft to foreign governments and colonies.
- (5) Labor (general question).
 - (a) Skilled and unskilled.
 - (b) Male and female, including military, wounded, pensioned, etc.

The problems to be considered in connection with foreign *aéronautics* were defined by Colonel O'Gorman as follows:

- (1) Post-war intergovernmental agreements (allied and enemy).
 - (a) Flying rights.
 - (b) Landing rights.
 - (c) "Rule of the road."
 - (d) Supply of aircraft to foreign governments.
 - (e) International law, prohibited areas, etc.
- (2) Registration of craft.
 - (a) Salvage by ships and by aircraft.
 - (b) Exchange of meteorological news.
- (3) Post office reciprocity.
 - (a) Prices for postage.
 - (b) Methods of collection and delivery.
 - (c) Agreed routes.
- (4) Customs and policing.
 - (a) Quarantine and aliens question.
- (5) The formation of industrial links, co-ordinating technical societies.

HOLT THOMAS' "COMMERCIAL *AÉRONAUTICS*"

The economic side of commercial *aéronautics* was discussed in a paper read before the *Aéronautic Society of Great Britain* on May 30, 1917, by Mr. G. Holt Thomas, one of the pioneer British *aéronautical* authorities. His paper discussed the cost of establishing and operating air lines between such points as London and Paris, London and Marseilles, and London and Constantinople. It also outlined possible air lines across the Atlantic and from London to Ceylon, London to Tokio, London to Sydney, and London to Vancouver. Like Lord Montagu and Colonel O'Gorman, Mr. Holt Thomas expressed his belief that transatlantic air lines will be established in the near future.

POSSIBILITY OF ESTABLISHING TRANSATLANTIC AIR LINES

Speaking of the possibility of crossing the Atlantic, Lord Montagu pointed out

that winds of from 40 to 50 miles per hour are not uncommon in the upper air in the temperate zone, while 30-mile winds are frequent; therefore in the case of flying even a favorable 30-mile wind would add 720 miles to the day's run, while a head wind of a like speed would take 720 miles off the distance covered. In other words, there would be a difference of 1,440 miles in every twenty-four hours between a 30-mile wind favorable to the course of the aëroplane and a 30-mile wind against it—a difference so great as to make longer mileage a matter of comparative indifference. To show what this may mean I have only to state that it is about 1,800 miles from a point in County Kerry in Ireland to St. John's, Newfoundland. Assuming that an aëroplane started from St. John's with a 30-mile westerly wind behind it, and was capable itself of a speed of 80 miles per hour, the combined speed of 110 miles an hour over the surface of the globe would mean that in about sixteen and a half hours after leaving St. John's the seaplane or aëroplane could alight on the coast of Ireland. With a contrary wind of 30 miles per hour the speed of the seaplane would be reduced to 50 miles per hour over the earth's surface, and the journey would take thirty-six hours instead of sixteen and a half, or nearly twenty hours longer.

Already there exist machines which, by substituting a load of petrol for a load of bombs, could remain in the air over sixteen hours, so I am not putting forward an impossible example.

It may be advisable, therefore, in some states of the atmosphere to fly to the North American continent via Iceland and Greenland; in other states of the atmosphere via France, Spain, Portugal and the Azores. The reasons for these circuitous routes will be seen in some diagrams which I shall show you. It is clear, therefore, that meteorology and the study of wind currents is going to be of supreme importance. The knowledge of the world's atmospheric conditions and accurate forecasts, apart from their inherent scientific interest, may affect the saving or spending of millions of money annually when postal and commercial aviation is established.

ITALY'S PRE-EMINENCE IN ESTABLISHING AIR LINES

Italy is far ahead of other nations in establishing air lines. It has had a number of air lines in actual operation for nearly a year, and Lieutenant Colonel O'Gorman and Mr. G. Holt Thomas have expressed their indebtedness to Major Perfetti, head of the special Italian Military Commission for Aëronautics in the United States, for the valuable data which he supplied them on the general subject of aërial transportation and the problems connected with international transportation.

Major Perfetti, who has accepted an invitation to become a member of the International Commission on Civil Aëronautics referred to previously, recently delivered an address in New York under the auspices of the Aero Club of America and the Automobile Club of America in which he made known the fact that Italy has been using for some time, and most successfully, huge warplanes, capable of lifting 2,750 pounds of bombs, besides the equipment in fuel needed for a flight of eight hours at a speed of 80 miles an hour. The latest Caproni triplanes are equipped with three motors of 600 horse-power each and will carry five tons of explosives and fuel for

twelve hours at a speed of about 80 miles an hour. Plans for a larger machine of this type, capable of carrying 50 passengers and of crossing the Atlantic with a sufficient load to make transatlantic transportation a commercial proposition, are being completed.

THE GERMAN PLANS FOR AËRIAL TRANSPORTATION

In a recent number of the *Tägliche Rundschau* the German plans for aërial transportation were outlined. A company has been formed under the name of "Central European International Aërial Traffic Company." The plans provide for three main air routes, as follows: (1) Hamburg, Berlin, Vienna, Budapest, Constantinople; (2) Strassburg, Stuttgart, Munich, Vienna, Budapest, Constantinople; (3) Berlin, Dresden, Prague, Vienna, Constantinople.

AËRONAUTICAL MAPS OF THE FUTURE

Now that aëroplanes have grown to such tremendous size and that the leading nations are planning to use aircraft extensively for transportation, an aëronautical map of the world will become a necessity. Besides a general map of this type it will be necessary to have more detailed maps of the permanent aërial routes; and in view of the changes in the aspect of the earth due to the seasons and the change from day to night, it may be well to have different editions for summer and winter flying and for daytime and night flying.

Night flying implies that the maps will have to show the location of the special lighthouses that will be set up for air travelers as well as photographic reproductions of cities as they look at night when lighted up. The lighthouses, of course, will be the landmarks for the pilots traveling at night. Maps for winter flying will need to place emphasis on special landmarks which will have to be established and which, by contrast, will permit the air pilot to recognize the place, notwithstanding the snow.

If the plan of having different types of air traffic at different levels is adopted, then it may also become necessary to have suitable maps for the different levels, according as the speed is limited or unlimited. Aëroplanes going at 80 miles an hour and flying at a height of only 3,000 feet must have many more landing places than machines flying at tremendous speeds at over 10,000 feet. These, being engaged in international air traffic, are like express trains flying between important centers and therefore do not need detailed maps.

Now that aëroplanes are brought to the size which permits them to travel several thousand miles without stopping and now that dirigibles can navigate the air between 50 and 60 hours at a time, aërial navigation is an established fact. Furthermore, aërial navigation is the only navigation that is international in character, because no natural obstacle can prevent the progress of the aircraft as natural obstacles prevent the progress of ships and trains.

SAVING THE CROPS FROM INJURY BY FROST

By ALEXANDER McADIE

Director of the Blue Hill Observatory

"A penny saved is twice earned" said Franklin, and one can not help wondering what that wise old gentleman would say today about food conservation and especially the problem of saving crops from injury by frost. Throughout Christendom at the present moment the uppermost topic of discussion is food. Apparently the outcome of this great war will be largely determined by the supply of food. In our own land as well as in other lands every effort has been made to increase the crop yield by adding to the acreage and by intensive cultivation. Fertilizers have been used as never before, farming operations go on by night as well as by day, tractors do the work of many horses, and in every direction there is intense striving for big harvests. Those of us who are not in the field do our bit by lessening the demand, practicing economy, and preventing waste. Is it not wise, then, to study natural wastage in all its forms? For Nature herself is the master spendthrift; and the yearly losses through natural conditions, such as droughts, pests, and frosts, easily exceed the savings of the community for a long period.

Now, if ever, is the time when every effort must be made to reduce the losses by frost. The problem is one in the geography of the lower air, or, in other words, frost is largely a matter of *local air drainage*. Frost can be mastered and, indeed, has been mastered in some localities.

The word "frost" has been used in three different senses: first, a freezing temperature; second, the spicular ice crystals; and third, the damage resulting from defrosting or frosting. The first is an erroneous usage and should be abandoned. The second interests the aërographer, or student of air motion and physics, while the third, which is the proper usage, interests the plant physiologist and the public. When water vapor in the air near the ground changes its form directly into ice we get the familiar spicular or pointed crystal which most of us call frost. It does not go through the intermediate state of being water, else frost would be frozen dew, and all the flakes would be little globes. After a still, clear cold night, with neither too much nor yet too little moisture present, we find next morning crystals covering the grass and lower foliage, and most of us think, if the deposit is at all heavy, that much damage has been done. If later the plants shrivel and blacken we think that the crystals did the mischief. On the contrary, Nature, through the agency of these crystals, was trying to cause a delay or lag in the cooling. By this very same method, which we shall later explain, namely the utilization of the fact that ice has a high specific

heat compared with that of air, delicate flowers may be saved in freezing weather. It may run counter to our established notion to say that frost crystals protect vegetation from injury, but they do. The destructive factor is the fall in temperature and the consequent expansion and contraction of the plant tissue and juices in opposite directions. More frequently

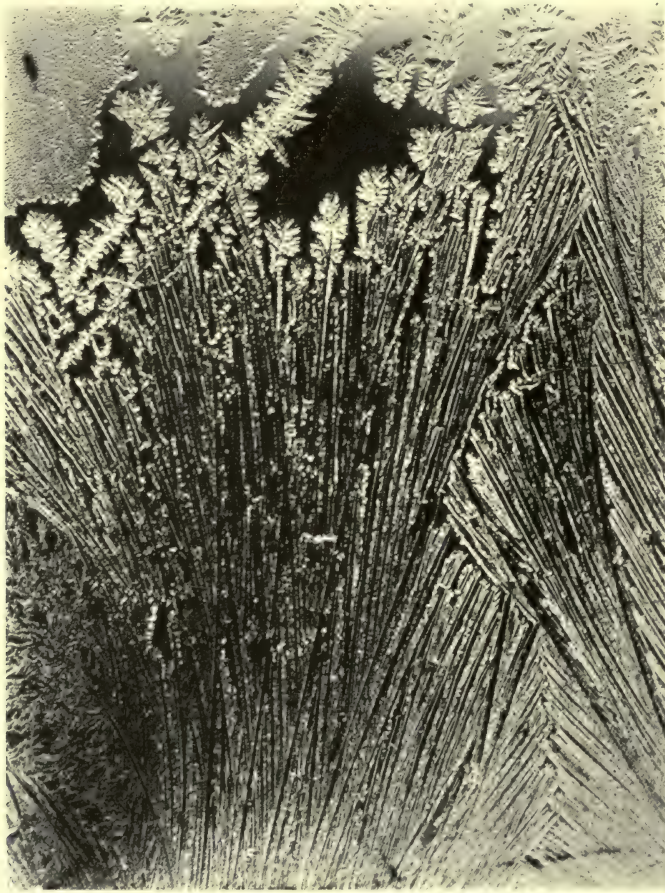


FIG. 1—The symmetrical beauty of frost lines. (All the illustrations are from photographs by the author.)

still the damage is due to a sudden rise in temperature after refrigeration. Probably it is the strain to which cells are subjected by rapid warming after chilling which does most of the damage known as frosting. It is not the freezing but the thawing which works the mischief. The writer found in the orange groves of California that in two hours the rise in temperature might amount to ten or fifteen degrees, i. e., at a rate far exceeding that at which the temperature fell, and, what was still worse, the upper side of an orange would be warm and the under side still frozen. The

damage was nearly always greatest where the fruit was freely exposed to the rays of the rising sun, and, other things being equal, a southeastern exposure was the worst. The remedy is cold water or a light smoke cloud, for we must check the sudden rise in temperature.

How shall we prevent or minimize the damage? We can do this, but not without some effort and at some expense. The fight, however, is worth



FIG. 2—Frost spicules, twice actual size.

while, as has been proved by the campaigns in the great fruit belts on the Pacific Slope. A brief review of what has been done in California will encourage the doubters.

One day in December, 1895, the general forecaster at San Francisco issued warnings of frost. The press of the orange belt made merry over the warning, but, to their surprise and discomfiture, the frosts came and the losses were heavy. A few horticulturists in Riverside met to talk over the situation and the forecaster was called in for consultation. Within a month one of the members had designed and tried out a wire basket, suspended about three feet above the ground and holding about ten pounds

of coal with the necessary kindling. That was the first of modern frost protectors, the Copley coal basket.¹ Other members tried movable smudgers and heated water suppliers, and on one ranch a covering of laths was tried, which, although expensive, proved its worth. A few years later came the first oil burner for use in the vineyards near Fresno, and from this all the present forms of orchard heaters have been developed. Eighteen years later, during the first week in January, 1913, the same forecaster had occasion to issue frost warnings, but with very different results, for the press spread them far and wide, leaving no stone unturned in urging the growers to smudge and fire *early*. It was necessary, for there followed the severest weather ever known in that section; and the battle was fairly joined between Nature and Man. Man won. There were plenty of thrilling experiences in this fight, and much could be told if time and space permitted. Moreover, in this war between man and nature there can be no end, for the fighting must be renewed as long as the seasons come and go.

How does the forecaster know that frost is coming? Chiefly by anticipating for the given localities a certain type of air flow or circulation near the ground, and which is largely determined by the lay of the land. To the general movement of storm areas and the accompanying winds he must add the cumulative effect of much gentler currents, so slow indeed that they might be called "creeping" currents. When a barometric depression, or "low," as it is called, moves briskly eastward and is followed by an anti-cyclonic circulation, or "high," as shown by the surface isobars, the latter will at certain times seem to settle down and stay quiescent for sixty or more hours. A stagnant "high" gives results quite different from the ordinary interchange of air. There is an absence of convectional currents; there is no mixing of the different layers of air; and, to use the term of a foreign meteorologist, there is no *churning*. This lasts for two, three, and sometimes four days and nights. It is easy to see now why frosty nights follow one another, why we seldom have more than three frosts in succession and why the last night may have the lowest temperature. It is also plain why still nights are frost nights and why there are no clouds, because whatever currents there are, are from above downward rather than upward. And finally the air, since it comes from above, is dry and pure, that is, free from dust and haze; and, while perhaps slowly heated by compression in falling, still it is not heated enough to overcome the chilling which follows from contact with the cold ground. And the ground goes on cooling all the more rapidly because the air is very pure and dry. Marked inversions of temperature take place, the cold air is down and can not get up and the warm air is up and can not get down. As a result of the slow side drainage, shallow ponds of stagnant air are formed. The forecaster who has, besides his air maps, topographic maps, can follow the cold air down into

¹ For a variety of frost-protecting appliances see the illustrations in W. G. Reed: *Protection from Damage by Frost*, *Geogr. Rev.*, Vol. 1, 1916, pp. 110-122.—EDIT. NOTE.



FIGS. 3 and 4.

FIG. 3—The Frost King. Skiron, the northwest wind, is the driest that blows at Athens. This wind is extremely cold in winter, but in summer it is scorching, violent, and accompanied by frequent and blinding flashes of lightning; it does great mischief to vegetation and affects the health of the inhabitants. There is an air of languor in the countenance of this figure; his upper tunic is short and has sleeves which reach to the wrist; the vase he holds is of a form quite different from the water jar in the hands of Notos; it is curiously wrought and probably represents a brazen fire pot from which he may be supposed to scatter ashes and burning coals. In the United States frosts, as a rule, follow a period of gusty northwest wind, which lulls at the approach of night.

FIG. 4 The Frost Protector. Notos, the south wind, is sultry and very wet. The sculptor has represented this wind by the figure of a young man emptying a jar of water. In the United States a south wind, as a rule, obstructs formation of frost.

Figures 3 and 4 are from photographs of the casts in the library at the Blue Hill Observatory, near Boston, placed there by the founder, the late Professor Rotch. The casts are reproductions of the figures on the Tower of the Winds at Athens erected about 200 B. C.

the lowlands, for it is heavier, bulk for bulk, than warm air and unless prevented will roll itself to the bottom.



FIG. 5—Sinuous frost effect.

The inclination of the valleys to the prevailing winds makes a difference. If the valleys are walled in so much the worse. The nature of the soil counts as well as the cover crop. Dark soils radiate more rapidly than light soils, while plowed and wet lands differ from unbroken and dry soils. Frost streaks are probably due to stagnant layers of cold air *resting* on chilled soils, for even a slow flow of the air will suffice to prevent frost. Crops on the hillsides escape for the double reason that the air is in motion and because the slopes front the level of warm air and, whatever flow there is, is from this warm level laterally to the slope.

We have said that the streams of cold air are very shallow—often only a few meters in depth. If we can divert or disturb these we can prevent the rapid cooling of the ground by radiation. How, then, shall we protect? A hint has been given above, namely to follow Nature. If we can not control the circulation, then spread a cover to conserve the earth heat. The cloud is the cover which Nature spreads, and even a light fleece will do the work, for there is no frost on cloudy nights, even when the clouds are high. Assuming that the agriculturist has been warned by the fore-

easter, what shall he do? Forewarned is forearmed, it is said; but not in this case unless the grower has prepared a supply of fuel, covering material, water, sand or fine ash, and has available labor. The easiest way

is to cover the plants with paper, cloth, straw, or mulch or make a cover of dense smoke by sprinkling water on small fires of brushwood soaked with oil. Or heat can be applied more directly by lighting many small fires or by using orchard heaters, which are metal containers holding about a gallon of crude oil. Large open fires are not effective because most of the heat goes into the higher levels, where it is not needed. The problem is to heat or displace a comparatively shallow stratum of air close to the ground. There is therefore no gain in having bonfires unless in some way a circulation can be established and warm air from above brought down. Unfortunately in most fields this is not the result, and the cold air is simply replaced by other cold air. The slight gain due to mixing and motion is not commensurate with the fuel used.



FIG. 6—Granular frost structure.

Another method is to mix the air or ventilate by blowers or windmills; but if there is much of a draft and the air is dry, some provision must be made for moistening. Other and more available methods involve the use of substances having a high specific heat, such as water, sand, or wood ashes. Of course flooding as practiced in the cranberry bogs is an old and effective preventive. On a smaller scale spraying with water that is moderately warm is good. A coating of ice does not necessarily result in injury, provided that both freezing and thawing are gradual.

For the average gardener or small fruit grower, however, the best method is that of covering. It is not exactly new, for our grandmothers knew enough to cover their favorite rose bushes, pinning paper over them and generally saving them. The one criticism is that the covering was easily displaced. The theory is simply that the heat waves re-emitted from the ground are intercepted by the cover, and the cooling of both ground and plant due to intensive radiation is stopped. It is wiser to use a more durable cover, preferably light waterproof material with proper fasteners. If

soil and plant are well watered before the cover is spread, so much the better. And finally it is an advantage to cover *early*, that is an hour or two before sunset rather than after. The method of direct heating has been used successfully in the fruit ranches of the West and Middle West; and about thirty oil pots to the acre will keep the temperature above freezing under average conditions.

Small growers as well as large growers can certainly save their crops from frost. In the aggregate the saving would be enormous.

THE VIRGIN ISLANDS OF THE UNITED STATES

By THEODOOR DE BOOY

Museum of the American Indian, Heye Foundation

After a kaleidoscopic career, unrivaled even by the ups and downs of other Antillean islands, the passing of the Danish West Indies to the rule of the United States probably marks the last change of ownership of this little group.

On his second voyage in November, 1493, Columbus sailed through the island group, which he named the Virgin Islands in honor of St. Ursula and the Eleven Thousand Virgins of the Catholic calendar. The islands were then populated by fierce Indian tribes, who resented the invasion of their shores and gave battle to the Spaniards. In fact, the first pitched battle in the Americas took place on the island of St. Croix, when the natives fearlessly attacked the landing party despatched in search of water to replenish the supply on the caravels. Men and women alike defended their shores against the invaders, and, while their crude weapons were of little effect against the defensive armor of the Spaniards, at least one of the soldiers of Columbus died from a wound inflicted by a poisoned arrow. One would almost believe that the Indians had a prophetic vision of the future annihilation of their race under the Spanish rule that was to follow.

For a considerable time after the discovery of the islands in 1493, no records speak of European settlement upon them. A century later, indeed, the Earl of Cumberland describes the islands as being "wholly uninhabited, sandy, barren, and craggy." The fate of the original population is surmised without difficulty. In the first decades of the sixteenth century it was a common practice for the governors of the nearby island of Hispaniola to send raiding expeditions to the Bahamas and other islands to supply the crying need for laborers in the gold mines of Santo Domingo. One is led to think that the Indians of the Virgin Islands were exterminated by these means. In fact, we know of a decree of Charles V proclaiming that the Virgin Islanders were to be treated as enemies and exterminated.

It was not until about 1625, so far as can be determined from the somewhat hazy records, that St. Croix was temporarily settled by a few colonists of Dutch and English nationality, and it is likely that St. Thomas and St. John also were occupied about this time. The usual strife marks this colonization, and it was not long before the Spaniards, ever jealous of other settlers in what they considered their lawful domains, put an end to the Dutch and English colonies of St. Croix by the simple means of massacring the inhabitants. Shortly after this the French made a more successful and lasting colonization of St. Croix and were able to repel the

Spanish attempts to drive them away. With some other islands, St. Croix was sold to the Knights of Malta in 1653, but was abandoned by the French settlers in 1695. The island remained practically uninhabited until 1733, when it was purchased from the French Government by King Christian VI of Denmark and was joined to the local government of the islands of St. Thomas and St. John. It continued under the Danish flag until 1801,

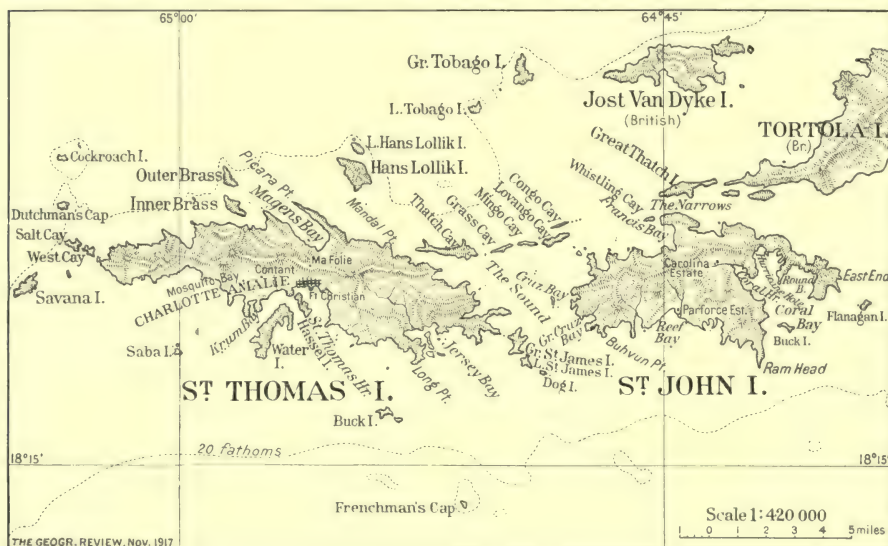


FIG. 1.—Sketch-map of the islands of St. Thomas and St. John. Scale, 1:420,000. Based on Danish Admiralty Chart No. 205, edition of 1914, and U.S. Hydrographic Office Charts Nos. 1002 and 965, dated 1886.

when the islands were taken by the British forces. Restored to Denmark in 1802, the islands were again captured by the British in 1807 and were held by them until 1815, when Denmark once more took possession.

The vicissitudes of the islands of St. Thomas and St. John, while not so varied as those of St. Croix, were also startling. After the temporary occupation in 1625 by a few Dutch colonists, the islands do not appear in the public eye until the year 1671, when the Danish West India and Guinea Company of Copenhagen took possession of St. Thomas. This prosperous company was directly responsible for the subsequent welfare of St. Thomas, and through it the harbor of St. Thomas first derived its commercial importance and from it St. John was permanently settled in 1717. Outside of a few unpleasant visits by buccaneers and a negro revolt on St. John, the two islands enjoyed a period of comparative quiet and considerable, if fluctuating, prosperity until 1801, when they were captured by the British. From this date on, the history of St. Thomas and St. John is the same as the history of St. Croix.¹

¹ See Waldemar Westergaard: *The Danish West Indies under Company Rule (1671-1754)*, New York, 1917. Reviewed in this number of the *Review*, under "Geographical Publications," below.

The most interesting historical relation of the Danish West Indies after 1815—their relation with the United States—is well known. In 1865 the United States offered the Danish Government the sum of \$5,000,000 for the islands, which offer was increased to \$7,500,000 two years later. The treaty providing for their purchase was ratified by the Danish parliament but for various political reasons was cancelled by the government at

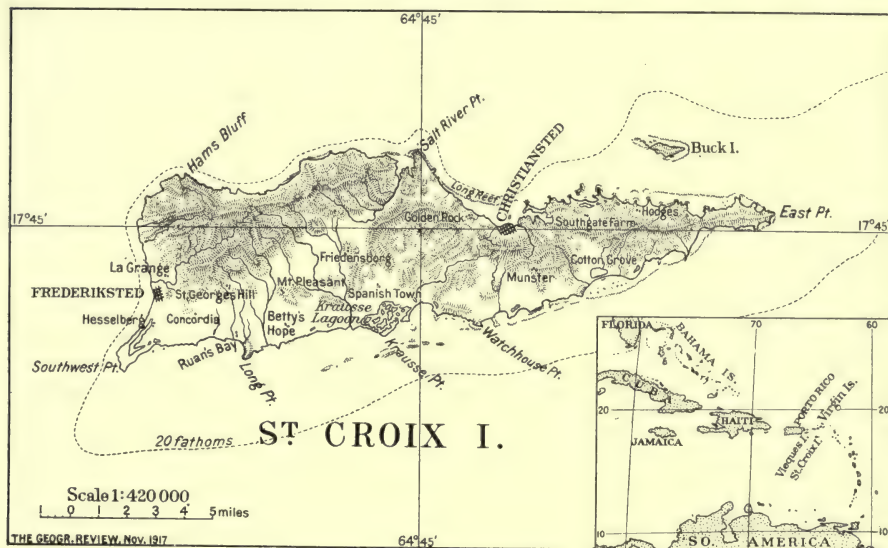


FIG. 2—Sketch-map of the island of St. Croix. Scale, 1:420,000. Based on U. S. Hydrographic Office Charts Nos. 1002, dated 1886, and 1423, dated 1894. The relation of Figures 1 and 2 may be established by noting that the meridian of 64° 45' W. cuts both St. John and St. Croix and that the latter lies about 40 miles due south of the former. The general location of the Virgin Islands is shown on the inset.

Washington. Again, in 1902 Denmark was offered \$5,000,000 for the islands, and, had it not been for German influence in the upper house of the Danish legislature, the sale would probably have been consummated. It was not until January 17, 1917, that the islands were finally sold to the United States. The sum paid was \$25,000,000; and the actual transfer to the United States Government took place on March 31, 1917, when the Stars and Stripes finally replaced the Dannebrog. It was decided by the United States Government to name the acquired territory the Virgin Islands of the United States, and they are now officially known by this name. It may be pointed out, however, that the southernmost island, St. Croix, in reality was not one of the Virgin Island group as named by Columbus.²

While negotiations between the United States and Denmark regarding the sale of the islands were in progress, considerable doubt was expressed by the general public as to their value as an investment. The argument

² Nor does it belong to the group physically (see note in the March, 1917, *Review*, p. 242).—EDIT. NOTE.



FIG. 3.—View of Charlotte Amalia, St. Thomas, looking west from the Frederiksberg. (Photo by Clarence Taylor.)

was advanced that, with the exception of St. Croix, the islands were practically non-productive, and one periodical went so far as to ask its readers if \$25,000,000 was not too high a price to pay for a bay rum factory. This latter remark, of course, pertained to St. John, where bay rum is produced.

Whatever may be the intrinsic worth of the islands, there can be no doubt that St. Thomas has an incalculable strategic value, and that its possession is of the greatest protection to the Panama Canal in the event of hostilities with any European Power. It lies directly in the steamer routes between European ports and the Canal Zone, and a fleet stationed in the adjacent waters, with the wonderful harbor of St. Thomas available for repairs and supplies, could dominate the approaches to the Caribbean. This fact appears to have been overlooked by those who considered that too high a price was paid for the islands.

It must of course be admitted that their mere commercial importance did not warrant so large an amount. Nevertheless they have considerable commercial value. What their resources are will be shown in the following pages, and, as the three islands are totally different in their productions, it will be necessary to discuss each island separately.

ST. THOMAS

St. Thomas, the westernmost island of the group, is the second largest: it measures fourteen miles in length from east to west, and is from one to three miles broad. In reality it is nothing but a curved mountain ridge whose highest elevation is 1,550 feet. The island has a population of about 10,000, of which by far the greater part are negroes. Much could be written of its people: of their amiability, of their kindness and hospitality to strangers, and of their pride in their little island. It is undoubtedly a great satisfaction to the United States that the inhabitants of St. Thomas were practically unanimous in their desire to be transferred from the Danish Government to that of Washington, and the rejoicing when the actual transfer took place was great. For, while the St. Thomians had no reason to complain of the treatment accorded them by the Danes, it was always felt that Denmark was a long way off and that in consequence a long time had to elapse before the sanction of the home government could be obtained for any change that might be desirable. Furthermore, owing to the proximity to the United States and because of the numerous American vessels that have been coming to the port of St. Thomas for coaling or other purposes, the working classes of the island are familiar with Americans and American methods. As a consequence of all this, it is not probable that the change of government will cause much dissatisfaction among the islanders or that it will be long before the St. Thomians become accustomed to the new régime.

The mountain ridge which forms the island curves northward in the



FIG. 4—Panoramic view of St. Thomas harbor and town of Charlotte Amalia, looking southward. (All photos, except Figs. 3 and 8, by the author.)

middle, leaving a corresponding basin on the south coast. It is this basin which forms the excellent harbor of Charlotte Amalia, as the town of St. Thomas is named. This harbor is unexcelled in the West Indies with the exception of Coral Bay on St. John. It offers complete protection to the largest ships, and the numerous inlets and smaller bays lend themselves admirably to the purposes of a naval base; large men-of-war may lie in the harbor itself, and smaller vessels, such as torpedo boats and supply ships, can take up positions in the inlets. With fortifications on the hills and mines in the approach to the harbor absolute safety may be insured.

Charlotte Amalia has about 8,000 inhabitants, who are mostly employed as stevedores and coal-passers upon the vessels that visit the port. Much has been written of the former commercial importance of St. Thomas when the island served as an entrepôt for the trade of practically the entire Windward Island group of the Caribbean. Upon the advent of direct steamer lines to the various islands the locational advantage waned, and St. Thomas lost a great deal of its prosperity. It is the common belief that now that the island is part of the United States some of its former prosperity will return and that the semi-deserted warehouses and docks will resound with the bustle of an increasing commerce.

The loss of commercial prestige had been preceded by the decline of agriculture, which, with the abolition of slavery, practically ceased to exist on the island. In the old days, when labor was inexpensive, sugar was raised in large quantities. This is attested by the ruins of old plantation buildings as well as by

trade figures. Many of these buildings picture the glory of the olden times, when the hospitality of the planters and their luxurious way of living were a by-word, and a ride through the island, with its views of ruined windmills and massively built mansions, is one of the interesting experiences of a visit to St. Thomas. Though a revival of profitable agriculture would not appear to be probable, much of the land could be used for the raising of cattle, for which there is always an active market.

One of the points of interest to tourists is the shipyard in Krum Bay to the westward of Charlotte Amalia. It is here that most of the vessels putting into St. Thomas harbor in distress, and afterwards condemned and sold by the insurance underwriters, are broken up. Krum Bay, in consequence, is generally spoken of as the graveyard of ships, and the owner boasts of the possession of a large number of the figureheads with which the old sailing vessels were decorated. These figureheads present a somewhat startling appearance when first seen; especially startling were they after the hurricane of October, 1916, when they lay scattered over the grounds in erratic confusion.

Automobiles are unknown on St. Thomas, as there are no roads upon which they can be used. Even carriages can go but limited distances, for the roads rapidly narrow to mountain trails, and even in the town itself there are many streets on the hillsides where a carriage cannot pass. Many of the streets are mere stone stairways, each having a big stone gutter, or "gut" as it is called in Charlotte Amalia, alongside, to carry off the water from the upper parts of the town.

The old Fort Christian, which in its later days was used as a police station and local prison, is one of the sights which no tourist to St. Thomas should miss. It is far more interesting than the so-called Bluebeard's and Blackbeard's castles usually recommended in the guide books. That it has but small strategic importance may be inferred from a complaint made by a certain Governor Iversen to one Carl Baggaert, who happened to be building a house in the year 1674. In this complaint the Governor said: "It is not advantageous to the Fort that Baggaert built his house so much higher than the Fort, insomuch that everyone who comes to him can completely overlook it." This interesting commentary, however, need not mar the visitor's enjoyment of Fort Christian; it is well worth viewing, and its cells and battlements testify to the solid methods of construction in the old days.

Nor should the tourist neglect to hire a horse and ride over the hills to the north side of the island. The ascent from Charlotte Amalia to Ma Folie, as the estate on the crest of the 1,500-foot hill is called, is startling in its abruptness. Standing on the crest, one sees to the south the town of Charlotte Amalia nestling on the slopes below and the wonderful harbor with its ships of all nationalities, its bright red fort, its floating dry dock, and all its other picturesque features. To the north one sees the



Fig. 5—Steep street with steps and gutter, Charlotte Amalia, St. Thomas.



Fig. 6—Battlements of Fort Christian, Charlotte Amalia, St. Thomas.

small islands of Inner Brass and Outer Brass, Hans Lollik, the British island Jost Van Dyke, and the deep inlet known as Magen's Bay, perhaps the prettiest bay in the Antilles. To the west one sees Crab Island, Culebra Island, and far-off Porto Rico. To the east, the island of St. John is clearly visible, and glimpses may be had of Tortola and all the other British islands of the Virgin group. Far off to the southward on clear days one can even make out the mountains of St. Croix.

The climate of the Virgin Islands is excellent, that of St. Thomas being perhaps the best. The nights are cool enough to allow one to sleep under a light blanket, and the days are very far from being oppressively hot. As a result, the inhabitants are healthy, and epidemics are rare.

ST. JOHN

The island of St. John, lying about three miles east of St. Thomas, is a little smaller in area than the latter. It is nine miles long and has an irregular breadth. The highest elevation is 1,300 feet, and, like St. Thomas, the whole island is hilly. The population consists of but 900 souls, and these lead a somewhat precarious and poverty-stricken existence.

St. John might well be termed the Cinderella of the Virgin Islands. If the average geographer be asked the name of the newly acquired Virgin Islands, he will reply: "St. Thomas, St. Croix," then pause and after deep thought add, "St. John." Published accounts of these additions to the territory of the United States make lengthy mention of the island of St. Thomas and its commercial and strategical importance, and of St. Croix with its agricultural possibilities, but dismiss St. John with a scant line or two telling of its bay trees and the poverty of its inhabitants.

The possibilities of exploiting St. John are great, however. In the first place, the bay tree flourishes on the little island. It has been found by actual experience that the bay tree is somewhat erratic and is most particular as to its habitat. Attempts have been made to grow this tree in various islands, and practically all attempts were failures. Even on St. John, small as it is, it seems that the trees do well in certain parts and are unable to gain a foothold in others. Why this is so has never been satisfactorily explained. But even with this drawback, there are today many regions on St. John where extensive cultivation of the bay tree would be highly profitable. The leaves of the bay tree are gathered and are distilled in the usual copper stills. This distillation results in the collecting of the natural oil, the bay oil, contained in the minute cells of the leaves. The bay oil is mixed with white rum in the ratio of about one quart of oil to five hundred quarts of rum, and the product is bay rum. Occasionally bay rum is made by distilling the bay leaves directly in the rum; but this method is slower and far more expensive and has practically been discontinued. The bay industry, therefore, presents one of the possibilities of St. John. While various proprietors are at present engaged in the cultiva-

tion of the trees and the distilling of the oil, there can be no doubt but that a greater exploitation of this industry would result in material benefit, especially if modern machinery for collecting the oil were employed.

Again, St. John offers great possibilities as a cattle-raising center. Perhaps no better-watered island exists in the Antilles. As a consequence, while the ground is generally steep and hilly, the slopes are covered with excellent grass of all varieties and offer feeding-grounds for thousands of heads of cattle. At the present time cattle raising seems to be neglected by practically the majority of the landowners. There can be no doubt that owing to the increased population of the neighboring island of St. Thomas through the prospective establishment of a naval station there, and also owing to the fact that no duty would have to be paid on cattle exported to Porto Rico now that the islands are under the same government, a ready market would be found for all cattle raised on St. John. St. Thomas can in no wise compare with St. John for pasturage or for water supply, and St. Croix is practically entirely given up to sugar cultivation.

The waters surrounding the numerous small keys that encircle St. John literally swarm with fish of all species. Perhaps no better fishing-grounds can be found in the Antilles than those between St. John and the keys to the westward, Congo Cay, Lovango Cay, Mingo Cay, and Grass Cay. For all that, there is practically always an unsatisfied demand for fresh fish in Charlotte Amalia. The demand for fish will naturally increase in the future. What, then, could be a more profitable investment than a suitable fishing-boat with a motor auxiliary? It could find a safe harbor in any one of the numerous bays of St. John, and with this island as a center could fish the surrounding waters and carry the catch to the St. Thomas market.

With the advent of modern intensive methods, sugar-cane cultivation on St. John would be a failure. While ruined plantation buildings bear mute evidence to the fact that St. John, like St. Thomas, was at one time a considerable producer of sugar, this was in the days when sugar was high and labor was cheap. With modern methods, St. John with its steep roads and hills could not compete with sugar-plantations on islands where flat areas make the gathering of the cane an insignificant item of expense.

But if the production of sugar would not be a profitable enterprise, undoubtedly truck-farming would amply reward anyone going into it on a large scale. The raising of all sorts of vegetables in the West Indies is a possibility which is frequently and strangely overlooked. The consumption of canned vegetables by the well-to-do of these regions is quite large, and such small quantities of fresh vegetables as are raised are in eager demand at good prices. It is a common mistake to suppose that the tropics are not suited to the production of garden truck: indeed, tomatoes, lettuce, beans, melons, etc., not only thrive, when well watered, but bear more prolifically than in northern climates. The raising of these



FIG. 7.



FIG. 8.

FIG. 7—Coral Bay, St. John. Tortola Island (British) in background. The white buildings are the Moravian Missionary settlement of Emmaus.

While Coral Bay, with its complete shelter from storms, its depth of water, and its numerous inlets, offers better facilities for a naval base than does St. Thomas harbor, its position with respect to the mountains of Tortola Island, upon which guns of heavy caliber could be mounted, would jeopardize the safety of a fleet.

FIG. 8—St. Thomas harbor looking eastward from foot of Careen Hill. (Photo by Clarence Taylor.)

on St. John would give employment to many, and a profitable market in St. Thomas would be assured.

It has been said that the acquisition of St. Thomas by the United States will mean an influx of travel and the erection of hotels. Here again St. John offers possibilities in many ways greater than those of St. Thomas. It is true that St. Thomas offers a busier outlook, and the ships that enter



FIG. 9.—Indian rock-carvings, Reef Bay, St. John.

its wonderful harbor are a constant attraction. But, on the other hand, while the scenery of St. Thomas is magnificent, that of St. John excels it. Climb any hilltop in St. John and look north, east, south, or west, and unrivaled views delight the eye. The surrounding islands, of a vivid green, seem to serve only to make the line of contrast between the pale blue sky and the dark blue sea more pronounced. Surely no other island in the Antilles offers views that can compare with these in natural beauty. Viewed from a hilltop the coloring of the surrounding bays ranges from a deep blue to a light green, limited on the one side by the white waves of

the reef and on the other side by the cream-colored sands of the beach. If the tourist is searching for the picturesque, it is found in abundant measure in the ruins of the old plantation buildings, whose walls and quaint staircases still exist in the tropical undergrowth. Is the tourist a lover of bathing, boating, fishing, riding, or hunting? All these sports can be followed on St. John. Is he interested in folklore or in the monuments of an extinct race? Strange tales will be told him of the uprising of the slaves in 1733 and of the ghost of the murdered daughter of the owner of the "Carolina" estate that still haunts the ancient mansion. He will be told of the three hundred escaping slaves who, when capture was inevitable, jumped from a towering precipice rather than surrender and perhaps die under the lash. Or again, a trip to the waterfall of Reef Bay, where strange rock carvings of the Indian inhabitants can be found upon the large boulders surrounding the pool, may satisfy the tourist's longing for a novel experience. Is the tourist interested in Colonial furniture? A ride through the island with frequent halts at the small cabins and huts will assuredly reward him with a "find" or two to boast of in later years to admiring friends.

It will be seen, therefore, that St. John, the Cinderella of the Virgin Islands, has her charms and that the exploitation of the island would well repay the original outlay. A suitable tropical hotel built on St. John to entertain the sort of traveler who is content with what the country offers and does not insist upon imported food would be well patronized. Let a few young and energetic men, accustomed to the handling of West Indian laborers, start produce farms on the rich soil of St. John, and they would be certain of large returns. Let some capitalist stock a farm with a large number of cattle of a breed that will thrive in this climate, and he would be certain of a profitable investment. Let the bay tree industry be encouraged by having expert agronomists advise the planters as to the best methods of increasing the groves. When all this is done, it will be found that St. John, now only a name and a small speck on the map, will become as important as its more prosperous sisters to the west and the south.

ST. CROIX

St. Croix is the largest of the newly acquired islands and is 22 miles long and of irregular breadth. While the island has large flat plains, it also has one mountain ridge, the highest elevation of which is about 1,100 feet. The population consists of some 15,000 souls, the majority of whom are agricultural laborers.

St. Croix is the one agricultural possibility of the Virgin Islands. Its extensive and fertile plains make it especially well adapted for sugar cane cultivation, and those fields and hill slopes that are not given up to this purpose serve as pasturage for the numerous cattle that are used in the carts necessary for the transportation of the cane to the sugar mills. As a consequence St. Croix possesses very little waste land, and numerous large sugar factories dot the landscape with their huge chimneys.

The motoring possibilities of St. Croix are excellent, and the island boasts of many cars. A ride over one of the roads with its fringe of coconut trees is one of the delightful experiences lying in wait for the tourist. An automobile trip from Frederiksted, where all large steamers calling at the island anchor, to Christiansted, the seat of government, is a source of constant delight to the eye; and, while the wild magnificence of St. John is lacking, the more orderly landscapes of St. Croix are preferred by many.

St. Croix has two large towns, Frederiksted and Christiansted. Owing to the dangerous reef which shuts out the large ships, Christiansted is only visited by small sailing vessels and consequently does not exhibit the hustle and bustle so noticeable in Frederiksted on steamer days. On the other hand, Christiansted being the seat of government, its buildings are larger and more important-looking than those of Frederiksted and the inhabitants more sensible of their importance. Furthermore, Christiansted boasts of having been the home of Alexander Hamilton, and the inhabitants do not

fail to point out his abode to the visiting tourist. Both Christiansted and Frederiksted have the usual forts of a style of architecture not unlike that of Fort Christian on St. Thomas; they serve to remind the tourist of the glories of bygone times, when buccaneers, privateers, and other enemies made life interesting to the more peaceful inhabitants of the Antilles.

Perhaps the most advertised curiosity of the island of St. Croix and more particularly of the town of Christiansted is the old schooner, the *Vigilant*. No visitor is allowed to escape from the island without being told that the *Vigilant* was built in the year 1802 and served at times as a privateersman with letters of marque from the Danish Government and again at times as a Danish gunboat. Tales are told of the running fight she had, while in the latter capacity, with a Spanish gunboat in which the Spaniard came off second best. Then again the *Vigilant* served as a slave-carrier and transported human cargoes from island to island in the West Indies before slavery was abolished. Finally, in the destructive hurricane which swept over the Virgin Islands on October 9, 1916, the old vessel was wrecked inside the Christiansted reef. She was raised, however, and now serves in the humble capacity of cargo-carrier in the interinsular trade. The tourist, after hearing all this, naturally wonders how a vessel could have existed for such a long period, over one hundred and ten years, in West Indian waters, where the teredo worm works quick destruction for all woods exposed to the sea. Consequently, if questioned, the owner of the *Vigilant* will admit that parts of the vessel have occasionally been renewed, and, if hard pressed, will finally confess that the only original part of the first vessel remaining is a small eight-foot piece of the oak keel!

St. Croix has had a somewhat disturbed existence for the last century or so, owing to labor conditions. As in St. Thomas and St. John, the visitor will remark the numerous ruined estate houses. Their ruin, however, was not caused by the hand of time, but was mostly occasioned by the negro uprising of 1848, when the slaves under the leadership of one General Bourdeaux (colored) revolted and insisted upon being emancipated. Severer even than this revolt was the so-called laborers' riot in 1878, when innumerable plantations were burned to the ground and many of the planters totally ruined.

There is, even at the present time, considerable labor unrest on St. Croix. It must be said that not all of the blame rests on the laborers, and that the planters could go far, with the present prices of sugar, towards paying better wages to the negroes. However this may be, St. Croix promises to increase in prosperity under the new rule when St. Croix sugar will not have to pay the former high duty upon entrance to the United States.

In conclusion, a few words regarding the destructive hurricane which visited these islands on the night of October 9 to 10, 1916, may not be amiss. Anyone familiar with West Indian literature becomes imbued with

the idea that hurricanes of the most destructive variety are the common lot of settlers on those islands. As a matter of fact, but three major hurricanes have visited the Virgin Islands during historical times. The first one was in the latter part of the seventeenth century, the second was in 1867, and the last was that of 1916. Of course, minor hurricanes and heavy blows are not infrequent,³ but destructive hurricanes are rare indeed. When they do occur, a bountiful nature quickly succeeds in restoring vegetation to its normal aspect; as for the destroyed houses, their flimsy construction means that they can easily be replaced.

³ E. B. Garriott: *West Indian Hurricanes* (*U. S. Weather Bureau Bull. H*, Washington, 1900) enumerates fifteen hurricanes as having affected St. Croix, St. Thomas, or the Virgin Islands between 1493 and 1855 (list, pp. 23-25). The same work contains a description of the storm of 1867 (pp. 52-53).

THE LAU ISLANDS OF FIJI

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The mere mention of Fiji suggests naked cannibals dancing fiendishly about a steaming pot of boiled missionary. Nakedness is still characteristic of most of the South Sea islanders, but the missionary has conquered. Now each morning, as the sun tips the horizon, the natives assemble in hut or on boat for their morning worship, and usually a Moody and Sankey hymn forms an important part of the service.

The Fiji Islands are most easily reached by the Canadian-Australian Royal Mail line sailing each month from Vancouver to Suva, the capital of the group, situated on Viti Levu, one of the two largest islands. The voyage occupies fourteen days, including a short stay at Honolulu, that gem city of the Pacific. The international date line lies just east of the group, and the tourist has the novel experience of going to bed Sunday night and waking up Tuesday morning.

Unfortunately the average visitor to Fiji comes away with a poor impression of the islands. This impression, however, rests entirely on a knowledge of Suva, a very unprepossessing town, especially when compared with Honolulu. Its shops, arranged along the water-front, are a miscellaneous collection of brick and wooden buildings of irregular height and rectangular architecture. The residential portion of the town is built on rolling hills rising abruptly to altitudes of 300 to 400 feet. The scattered houses are given a square, boxlike appearance by reed shutters which conceal the otherwise hospitable verandas. These large shutters swing out from the bottom and are propped up in fair weather but are closed when hurricanes threaten. The residential hills are composed of fine, clayey marl which is innocent enough on dry days; but, as Suva has a record rainfall of 33 inches in twenty-four hours and is frequently deluged by cloudbursts which approximate the record, the marl is usually a slimy substance which clings to the feet persistently and has been called, erroneously but very appropriately, "soapstone."

The man who knows Fiji does not remain long in Suva but engages passage on the inter-island boat, the *Amra*, and sails away to pleasanter scenes. The *Amra*, as her name suggests, was built for the British-India trade but has long been plying between the reefs and islands of Fiji. The steamboat captain of the Atlantic has many worries, but they are not the worries of the captain in Fiji. Coral reefs have a curious habit of appearing in the most unexpected places; and, as the *Amra* is somewhat of a parcels-post ship and has to put in at the most out-of-the-way harbors, her

captain is frequently in trouble and finds his boat with a falling tide perched high on an isolated coral knoll. Frequently when creeping into port before dawn the captain approaches land with the ship's anchor half dropped, fishing as it were for bottom. As soon as the anchor grounds the engines are stopped and the ship lies to, while the large whaleboats pull away to shore and return with a cargo of copra, the dried kernels of the coconut.

The *Amra* makes a short trip every two weeks to Levuka, the old capital of the group; to Taviuni, the "Garden of Fiji," whose high volcanic ridges are covered to altitudes of nearly a thousand feet with coconut trees; and to Lambasa, on the northern side of Vanua Levu, where a broad delta plain yields an abundant sugar-cane harvest. Once a month the trip is extended to the Lau, or Eastern, Islands. Several of the northern members of this group are visited, the regular port-of-call being Loma Loma, situated on the island of Vanua Mbalavu (The Long Land), so called from its shape.

Loma Loma has lost much of its old glory. In the whaling days many Yankee sailors put in at the Exploring Isles, the sub-group to which Vanua Mbalavu belongs, and even today one of the eastern openings through the reef is known as the American Passage. During the Civil War a thriving colony of Southerners grew up. Cotton was introduced and the place boomed. Now a few stray cotton-bushes mark the waste places of the island, only two or three white families remain, and the weedy Botanical Gardens tell of the departed glory. Dr. St. Johnston, the resident district commissioner of the British government, is now endeavoring to beautify the gardens and has placed in them several old cannon captured by the natives in cannibal days from stranded men-of-war. But rarely does he have an opportunity to show the gardens or the near-by hot springs to an appreciative visitor.

There are but two types of scenery in the Lau group, that of the volcanic islands and that of the limestone islands. The volcanic islands are seldom very high. Isolated peaks rise to an altitude of 1,000 or 1,200 feet, but the average elevation is between 500 and 800 feet. They are older than the volcanoes of Taviuni, their soil has been leached of most of its goodness, and their summits have been lowered until they no longer intercept the passing trade winds sufficiently to obtain a portion of their moisture. The slopes are usually brown and seer and are clothed only with reeds. The rolling hills are occasionally broken by irregular masses of agglomerate and lava, which rise like weird sentinels over the waste. An isolated *noku-noku* tree, reminding one of a stunted larch, or a Pandanus palm, here and there relieves the monotony.

The charm of the volcanic islands lies not in the shoreward view but in the splendor of the sunlight, which almost continuously bathes the blue waters of the Pacific, and in the varying colors of the ocean. In the distance it breaks in foam over the outer reef. Between, various coral patches



FIG. 1—Village on Ongea Levu, one of the southernmost islands of the Lau group of the Fiji Islands.

dot the lagoon; and, close at hand, the coral sand dips beneath the sea, which changes from yellow to green and from green to blue until the rich indigo of the deeper waters appears.

At intervals miniature jetties extend out from the shore and curve back again; these are native fish traps serving to strand the fish as the tide goes out. Again, at intervals along the coast on the sloping beaches, reed mazes supported by stakes serve to beguile the fish. One of the exciting sports of the island is to endeavor to spear the fish entrapped in these mazes. The natives are expert in the use of long spears tipped with three straight prongs, and even on the outer reef they are able to stand on the slippery coral with the waves beating about their legs and outwit the most agile fish.

The limestone islands are built of coral débris which has been elevated 300 to 1,100 feet above the ocean. When seen from a distance their outline is that of a mesa on our western plains. A broad, flat summit descends by a series of two or three steps to the sea level. On closer approach the cliffs stand out more distinctly. They rise abruptly from a narrow, sandy beach, or even from the water's edge, to altitudes of 200 or 300 feet and are scaled with the greatest difficulty.

It is often impossible to walk along the shores of such islands except at low tide, and then only by crawling over sharp points of dissolving limestone and bending double beneath an overhanging cliff which has been undercut 5 or 8 feet by the sea. Many of the islands have central depressions, some of which contain lakes connected with the sea by a series of underground channels. Natural shafts from the surface often descend to these tidal channels. Chambers and alcoves are thus formed, and it is a weird experience to stand near tide level and see a native dive beneath a wall of limestone and appear later on a balcony far above the surface of the water.

Vanua Mbalavu combines the scenery of the volcanic and the limestone islands. Its central portion is volcanic; but a large area of limestone tips its northern end, and a smaller mass forms the southern connecting link to other limestone islands which have been separated by the erosion of a narrow strait. The limestone scenery may be seen at its best by a gallop on horseback for twenty miles along the coast from Loma Loma northward to the home of Mr. Augustus Hennings at Mba Vatu (The Rock Wall). The government is now completing a road which will make the journey much easier than it has been in the past. At first the way leads through coconut groves lining a coast formed largely of volcanic ash and agglomerate. Occasionally it passes through a native village. Ten or fifteen reed huts stand far back from the road, and hedges of brilliant hibiscus or variegated shrubs line the path on either side. Soon, as a sharp point is rounded, a group of peculiar islets appear off the coast. They are but 15 or 20 feet in height and 30 to 50 feet broad but are deeply undercut by the sea, presenting the appearance of huge mushrooms growing out of the ocean. They

are the scattered remnants of large masses of limestone which once formed the coast. Farther on the gentle slopes of the volcanic hills suddenly disappear and sharp limestone cliffs rise abruptly from the coral sands. Five or six miles more and the road leads up over the steep cliffs to Mr. Hennings' house. Mr. Hennings is the son of one of the oldest settlers of the islands and of Andi Mary, a daughter of Thakombau, the great chief who ceded the group to England. He is devoutly revered by the natives, and a visit to his home is ill-timed if a group of voyagers from some distant island do not appear in their communal cutter bringing gifts to their lord. Though the old tribal government is gradually breaking down, many of its customs are still maintained, especially those which tend to break the monotony of island life.

Mr. Hennings' house is built of mortar, the lime being made from bits of coral gathered off the reef. It stands amidst coconut trees near the edge of a precipice looking down into a long, narrow bay. No beach marks the shore of this bay. Unscalable cliffs rise directly from the sea. Standing in front of the house one may see sharks swimming in the clear, blue water 250 feet below. The bay of Mba Vatu is a mile long and slightly over a quarter of a mile in width. No river valleys enter it; its shores are a continuous rock wall, as its name implies. Large steamers may enter the bay and sail to its head, anchoring in the very shadow of its lofty cliffs. The beauty of the scene is striking. The dark green colors of the shaded water contrast with the white and cream of the limestone cliffs, on whose summits the waving palm trees are outlined against the sky.

A walk of half a mile across a narrow neck brings one to the "Bay of Islands." The natives call it Iloilo-ngilangila, "Bay of Mirrored Islands." Hundreds of them, great and small, dot the encircled waters, which enter between jutting points into pocket harbors. A natural balcony overlooks the bay, and through the foliage of hanging vines and tropical trees one catches faint glimpses of distant islands, while the roar of the breakers on the outer reef falls on the ear.

Life in a home like that of Mr. Hennings is delightful. The latest reviews from both England and Australia lie on the table. Tropical foods deliciously prepared by a Chinese cook are served by Hindu servants in the most approved style. One has not really seen Fiji, however, until he has made acquaintance with the natives. I hired a native boy, Hosea, who had learned a little English in a Wesleyan mission school, and together we set out to tour the island of Vanua Mbalavu. I am a geologist by profession, and my reputation was soon established. The Fijians are not unlike other peoples in believing that the lure of gold alone can account for the queer activities of one of my calling. Tuki Vatu, "Hammer the Rocks," soon came to be my name, and Mr. Hennings was kind enough to add the title Ratu—the title given the higher chiefs. The procession advanced with Hosea in the lead. Across his shoulder was poised a carrying-rod, from one end of which was

suspended a dress-suit case and from the other a rubber blanket containing bedding. The bedding is biblical in its simplicity. A small pillow, a steamer-rug, a native mat of braided bark, and a mosquito net complete the outfit. I followed behind with the collecting-bags containing a few canned goods to eke out the native fare.

Natives who have come much into contact with the whites are apt to be sophisticated and inhospitable, but in the Lau group such natives are seldom found. Thanks to a letter from Dr. St. Johnston our progress was not marred by the slightest discourtesy. The Fijians have learned to respect



FIG. 2 -Undercut islets of coral limestone at Ongea Bay, Lau group of the Fiji Islands.

personal property and rarely take what is not theirs, if food be excepted. Food is held to be common property, and servants, unless given strict orders to the contrary, consider it entirely proper to help themselves to the canned goods. *Mbulamakau* is especially appreciated. That word may appear strange to an American eye, but a little reflection will show that the natives did not distinguish between the two English terms "bull" and "cow," and hence all beef is called by a compound title.

On entering a village the first man to be sought is the *turanga-ni-koro*, the elective head of the community. All Fijians have a genius for shaking hands, hence it is frequently necessary to greet the whole village before their chief appears. They approach deferentially, their body half bent forward, and one by one grasp your hand as they give the native greeting, "*Sa mbula*," two words which constitute half of the Fijian vocabulary. The *turanga-ni-koro* seldom reads the letter of introduction; not because he cannot, but because it is beneath his dignity. After the contents are

made known his welcome is renewed, and a boy is dispatched to tell his wife to prepare her house.

There are three types of houses in Fiji, but they all have certain characteristics in common. They are always 15 to 18 feet wide and 20 to 25 feet long. They stand on raised embankments slightly larger than the house and held up by walls of rounded boulders. Their front door-steps are fashioned from a log, notched to accommodate the grasping toes of a native but dangerous for English boots on a muddy day. Three doors are cut on as many sides of the house, one end being left intact. The walls are so low that even a man of ordinary height must stoop to enter the doorway. The Tongan house has reed walls woven in an attractive fashion and usually free from vermin. The ends of such houses are rounded, differing from the ends of the Fijian houses, which are square. The walls of the true Fijian house are built of grass, bound into a mat a foot in thickness. Such walls are protective against the heat of the tropics but become musty during the rainy season. Furthermore they are usually the nesting place of mice, which disturb the slumbers of even the weariest of wayfarers. Cockroaches, two inches in length, are also common; but as they are found even in the best houses of Fiji no apology need be made for them. A third type of house has a thatch of braided palm leaves. In some cases the reed houses have roofs of this thatch, and occasionally it is continued to the side walls.

The massive beams which support the houses are wound with *mangi-mangi*, a rope braided from the shreds of coconut bark. Here and there white cowry shells are attached to the rope to decorate the interior. Occasionally the ridgepole is ornamented in a like manner. A raised platform, two or more feet in height and seven feet wide, occupies the entire closed end of the house. Braided mats of bark cover the hay which is laid over the floor as well as over the platform. Brilliant yarns fringe the edges of these mats where they hang down. Above the platform a mosquito net is hung from the roof by its four corners with bits of colored tape sewed in about its edge. This end of the house is the sleeping compartment. Four or five of the family find repose beneath the net, while the others sleep on the floor. The articles of furniture are very simple; a wooden pillow similar to those used by the Japanese, a Chinese wooden chest, occasionally a table, and frequently a hanging lamp. The few dishes are tucked into the walls or rest in the sun on a raised stand just outside the door. A huge wooden bowl (the use of which will be explained later) occupies a conspicuous place on the wall.

As soon as the goodwife has swept the mats and removed the baby to the cookhouse in the rear, the hut is ready for occupancy. Hosea replaces the native mosquito net, which is full of holes, with my own and arranges the bedding. These duties are hardly finished when the ceremonies begin.

A root of *yangona* or kava is presented by the elders of the town with

much palaver. The root is then taken outside the door and cut into bits an inch or more in length. These pieces are crushed in a wooden mortar (formerly they were chewed by the maidens) and infused with water in the large wooden bowl just referred to. When the infusion is complete it is strained through a mass of fibers from the paper mulberry tree. The master of ceremonies then claps his hands five times, holding the mulberry fibers between his palms. A huge half coconut shell is brought and filled by wringing the fiber into it. The cup is then passed to those present in order of rank. The beverage looks like dirty dish-water; to the palate it is an electric shock; but as nothing in Fiji quenches thirst so effectively as this drink, its disagreeable taste is soon forgotten. It is always well to have an understanding with the master of ceremonies beforehand in order that Fijian etiquette may not be shattered. It is exceedingly impolite to remove the cup from the lips before it is emptied. Since a pint of kava is not easily drunk at one draft, it is well to signify how much can be drunk; otherwise the cup is sipped like tea amidst a group of smiling natives.

After the *yangona* ceremony is over the women assemble outside the house and come in one by one bringing offerings of cooked vegetables on platters of braided palm covered with banana leaves. The leaves are placed on the floor and the food is assigned to the various groups present by the *turangani-koro*. The last woman who enters always bears a pot; and thereby hangs a tale. That pot may contain a chicken or it may contain prawns cooked in coconut oil. The latter dish is most delicious, but the former cannot be mentioned without pain. One short half-hour before the chicken was enjoying life. He was run to death by a small boy, thrust into the boiling pot—stripped of little else but his feathers—and placed on the table (consisting of an extra mat on the floor) with one glazed eye looking sadly up as though inquiring what sin he had committed to merit so untimely a death. The vegetables vary in their attractiveness. A bit of *ndalo* (taro) is palatable when well cooked. *Kauai*, or tapioca root, is not bad but rather too shreddy for most persons. Breadfruit roasted in the coals tastes like roast chestnuts. Boiled *cumalas* resemble boiled sweet potatoes but are usually too salvy for Europeans. Boiled green bananas are too bitter for the ordinary taste.

The evening after the meal is devoted to a discussion of the war. Most of the natives read a little and are intensely interested in filling out their own ideas concerning the great struggle. They obtain a bare outline of the events from the *Na Mata*, a monthly magazine edited by Mr. Allardyce of the Native Department of Suva. Several *mékés*, or motion dances, have been invented by natives to commemorate special events which have struck their fancy. One such *méké* depicts a fight in the air between a Japanese and a German aeroplane. The Japanese warrior wins and the song ends with three lusty "Hip-hip-hoorays." Before the evening is over several of the maidens with their hair braided down over one shoulder perform



FIG. 3.



FIG. 4.

FIG. 3—Harbor of a limestone island (Tuvutha, a northern member of the Lau group of the Fiji Islands).

FIG. 4—Framework of a Tongan house, Loma Loma, a village on Vanua Mbalavu, the northernmost island of the Lau group of the Fiji Islands.

one of these dances. They sit in a row on the floor with crossed legs and bend gracefully back and forth as they extend their slender arms in perfect rhythm to a measure beaten on sections of bamboo by several small boys. At first these dances are entertaining; but, as the Fijians like to prolong their concerts to three or four o'clock in the morning and repeat them without change several nights in succession, they soon become monotonous, especially since there is no way to get rid of visitors except by turning them out of the house. As the dances are given in honor of the guest, it would not appear exactly proper for him to treat his host so inconsiderately. Nevertheless it is soon found that the removal of a shoe, or even a quiet nap, is not taken as a hint to withdraw, and at last the tedious songs have to be ended by the announcement that the *papalangi* would like to be left alone that they may sleep.

It may well be seen that life in a native village is attractive at first but soon loses its charm. What is true of life in a village is doubly true of life aboard a native boat. The many tales of the beauty of Fulanga led the writer to engage a cutter and voyage nearly 200 miles southward to this remote island. The cutter was owned by the Wesleyan society of Australia and was commanded by Capitani Tevita (David), a jolly seaman but a sore trial. He had the social disposition of all the natives and could not find it in his heart to pass an island without a short visit to his friends. The days of travel were hence numbered by the islands passed. He always had plausible reasons—a sail was torn, the rudder needed mending, or a hurricane threatened; but the real reason was usually the booming signals beaten on a hollow log, proclaiming that a feast of roast shark or some other dainty was prepared ashore.

Sailing on the *Lotu Wesele* was very enjoyable as long as it did not rain and as long as the wind continued to blow. To toss about in one spot on the Pacific, however, is not conducive to happiness. The scorching sun pours down on the flapping sails and makes the cabin unbearable. Even a faint breath of air moving over the ocean is a comfort. There are no chairs, and so you sit and read with your legs extended on the heated deck. Soon reading becomes tedious and sleep overcomes you. And when you wake you find that even sleep has lost its efficacy. Or, again, a gale is dashing the spray over the ship's side. There is no retreat but the cabin. The hatch is pulled tight and you are crowded in with the natives and all their smells. Several wreaths decorate the cabin wall. Once they were fragrant, but now their stale odor is mingled with those of kerosene, coconut oil, and vile tobacco, for the Fijians, both men and women, smoke the strongest tobacco known to mankind. The combined effect is a good deal of a strain for the normal human stomach, and life is no longer rosy.

The first stage of the voyage from Loma Loma to Fulanga is the sail out of the Exploring Isles to Lakemba, the old capital of Maafu. Maafu was a Tongan conqueror who wrested the Lau Islands from the Fijians and

would probably have laid all Fiji under tribute had not his course been checked by the cession of the islands to Britain. The sail occupies half a day with favoring winds and three days with adverse winds. Captain David occupied eight days in visiting his friends, baptizing babies into the Methodist communion, and resting on the Sabbath, on which day no Christian will sail a boat in Fiji—unless well paid for his trouble. At last Lakemba was sighted and all were glad to be rid of the confinement of the boat. The Tui Naiau (King of Naiau), a direct descendant of Maafu, welcomed us, and Mr. Amos, the head of the Wesleyan missions for Lau, invited the party to a turkey dinner at the mission school, beautifully situated on a hill scarp overlooking the harbor.

After a rest of a few days, in which a number of the marvelous domes in the limestone caves about the edge of the island were visited, Captain David was persuaded to leave his friends, and again the *Lotu Wesele* set sail. The nights were still made hideous by beds of hard wood and sudden showers, but the days were glorious with their brisk winds and bright sunlight. The ship now and again sailed swiftly by the edge of a reef; a trawling line was let out astern, and a queer fish, shaped like a small torpedo and colored blue and yellow, was caught. It weighed 60 or 70 pounds and relieved the monotony of curry and rice alternating with Campbell's soups. Small islands were sighted, uninhabited except by a few stray goats which, with the pigs, are all said to have descended from ancestors that sailed with Captain Cook.

The first hint that we were nearing Fulanga was the appearance in the distance of a native outrigger canoe with a mat sail. She swiftly came alongside, and we wondered at the confidence of these people who ventured so far from land in so frail a bark. The canoes are much swifter than the cutters, and natives often prefer to sail from island to island or even from Fiji to Tonga in their canoes rather than to depend on the slower passage of a cutter. The government, however, is now preventing such voyages, since many lives have been lost in the sudden hurricanes of the region. Entering Fulanga harbor in a fifteen-ton cutter is an exciting experience. On either side projecting ledges of coral are barely covered by the inrushing tide. Their sloping surface is laid bare as each wave recedes, and the huge, green, fungus-like masses of living coral which mark the outer edge of the reef are constant reminders that a wrong twist of the tiller would dash the boat to pieces on the treacherous bar.

Few Europeans have seen Fulanga, yet it is one of the most beautiful spots in Fiji. The entrance to the bay was so narrow that Alexander Agassiz, passing in his steam-yacht, the *Yaralla*, was unable to enter. On either side of the entrance islands of uplifted coral limestone rise to altitudes of 50 to 100 feet. They have been undercut by waves beating against their bases from both the open ocean and the lagoon, and their triangular masses rest on broad pedestals like white haystacks on a salt

marsh. Once inside the almost continuous, circular rim of the group of islands about the lagoon, the whole lagoon is seen to be dotted with undercut islets. To one who stands on the higher crescentic island which forms the southwestern portion of the outer rim and which rises to an elevation of 250 feet, the many smaller islands resting on the smooth waters of the lagoon present a marvelous picture in the sunlight. Around the shore solution pits in the limestone are abandoned by the sea at low tide. In them rest large starfish, rich indigo blue in color, while minute blue-and-gold fish dart in and out among the heads of growing coral.

The whole island is a fairy land of weird beauty; but it soon appeared that beauty and happiness do not always keep company, for the people of the island were near starvation. A recent hurricane had destroyed their coconut trees, and drought had prevented the development of the ordinary quick-growing crops. They were living on the dried pods of the *ndongo* tree, which resemble those of the catalpa. The government later furnished them with rice. While on the island we were forced to drink coconut water, since the cement cisterns built by the government were empty. The poverty of the natives did not detract from their hospitality. A chicken was found and was really better cooked than at any other place we visited. The usual ceremonies were performed, and a rare bit of tapa cloth, beaten out of the bark of the paper mulberry tree and decorated with native dyes, was presented.

The limestone islands about Fulanga are noted for their large, native mahogany trees. A white wood known as *vesi* is also common. The two woods are worked up by the native wood-carvers into combs and pillows. The combs with their long teeth are the only effective means of unraveling the long, kinky locks of the Fijians and are assiduously used in producing the odd head-dresses so carefully wrought out. The hair is further beautified from time to time by the use of a thick paste of lime which changes its natural black to a door-mat red hue.

One evening the house in which we were staying in Fulanga was visited by the native missionary. It is the custom for him to conduct a prayer meeting once a week at some house in the village. The missionary was tall and thin. His white cotton *sulu* (waist-cloth) and white coat set off his figure to good effect. His thin whiskers gave his face an Arabic look, for the features of the Tongans are often quite Caucasian in their regularity. A song was sung,

*Sere tale mai kivei au,
Vosa ni mbula nga.
(Sing them over again to me,
Wonderful words of life.)*

The pastor then offered a fervent prayer, including a request that the Good Lord would watch over and bless the strangers. Even the hardest heart could not help being touched by the simplicity of a Fijian prayer.

After the meeting we spoke of the old days; but it was useless to try to persuade the pastor to tell of the cannibal feasts he had witnessed. The older Fijians are usually much ashamed of their past history and will rarely mention it. The younger generation are less delicate but seldom tell the truth, choosing rather to relate a pleasing tale. Some of the old heathen moral standards still exist, and the upward progress of the race is slow. The government educates a few in its school near Suva for clerical positions of minor importance. The Wesleyan church is conducting a very successful trade school, but for the masses there is no organized education above the village school conducted in a haphazard way by the native preacher. A little reading, writing, and arithmetic comprise their education. Their religion is largely emotional, as might be expected. Long prayers, long speeches, and much singing are the measure of religious experience, and few allow their religion to interfere with their daily life. Yet when it is considered that the race is but thirty or forty years removed from cannibalism, the transformation effected largely by the Wesleyan church is truly wonderful.

The Fijians are a happy, childlike race, kind to their friends and never violent to their enemies unless they can sneak up behind and deliver a blow without danger to themselves. They will take any amount of verbal abuse without a murmur, and nothing is more provoking than the calm smile with which a servant receives the most vehement scolding. A happy and long life with plenty to eat is their ideal, and ambition is nipped in the bud by a spirit of communism that forces everyone to share his gains with the rest of his class. Even a watch or a coat must be relinquished if a superior merely asks for it. Yet withall, there is a lure about the tropics which is not easily resisted even by a race with higher ideals. Desire for ease and love of beauty are inherent in all of us, and the harsh struggle for existence in a colder climate has led many a man with shattered hopes to find a home among the care-free children of Fiji.

THE DISTRIBUTION OF BRITISH CITIES, AND THE EMPIRE

By MARK JEFFERSON

The keynote of the diagram of the cities of the United Kingdom on the next two pages (Fig. 1) is that they occur in *swarms*. Four outer swarms at London, South Wales, the Clyde, and Newcastle surround a central group of swarms in the Midlands. Each of these swarms, except the London one, is on a coalfield. Of the 415 British cities outside of the London Basin, 307, or 74 per cent of them all, are so situated. This is unique.

England's supply of coal is unique, too. Figure 2 shows the coalfields as well as the 40 cities of more than 100,000 people.¹ The double-page map includes smaller ones down to 10,000. England's supply of coal is unique because she has so much in so small a space. The following table contains data to emphasize this point.

	AREA IN SQUARE MILES	COAL PRODUCTION, 1911, IN MILLION SHORT TONS	EXPORTS OF MANUFACTURES, 1912, IN MILLION DOLLARS
United Kingdom.....	121,633	304	1874
United States.....	3,026,789	496	1020
German Empire.....	208,780	258	1430

We are wont to say the United States leads the world in coal production. We should note, however, that the United Kingdom has but a twenty-fifth as much territory as the United States. The facts are that it produces about 60 per cent as much coal from 4 per cent as much land, or about *fifteen times as much from equivalent areas*. For every square mile of territory the United Kingdom produced 2,496 tons of coal in 1911, Germany 1,236 tons and the United States only 164. It is true that the United States produces more coal than any other country in the world, yet, if its area is considered, it is simply not in the same class, as a coal producer, with the United Kingdom. That is what is meant by calling England's coal supply unique. It has no peer.

The swarming of British cities on the coalfields, too, is unique. Neither Germany nor the United States has anything like it. Germany has a single swarm of cities on the Ruhr field, the admiration and wonder of all German students. There are to be found 11 of Germany's 47 cities of 100,000. But of Britain's 40 great cities 27 stand on the coal, 67 per cent against 23. The United States has only two of its great cities, Pittsburg and Scranton, on

¹ By "cities" are here meant geographical cities, i. e., continuous population centers irrespective of administrative divisions: thus Gateshead is included in Newcastle, Birkenhead in Liverpool, Salford in Manchester, and the London suburbs in London.



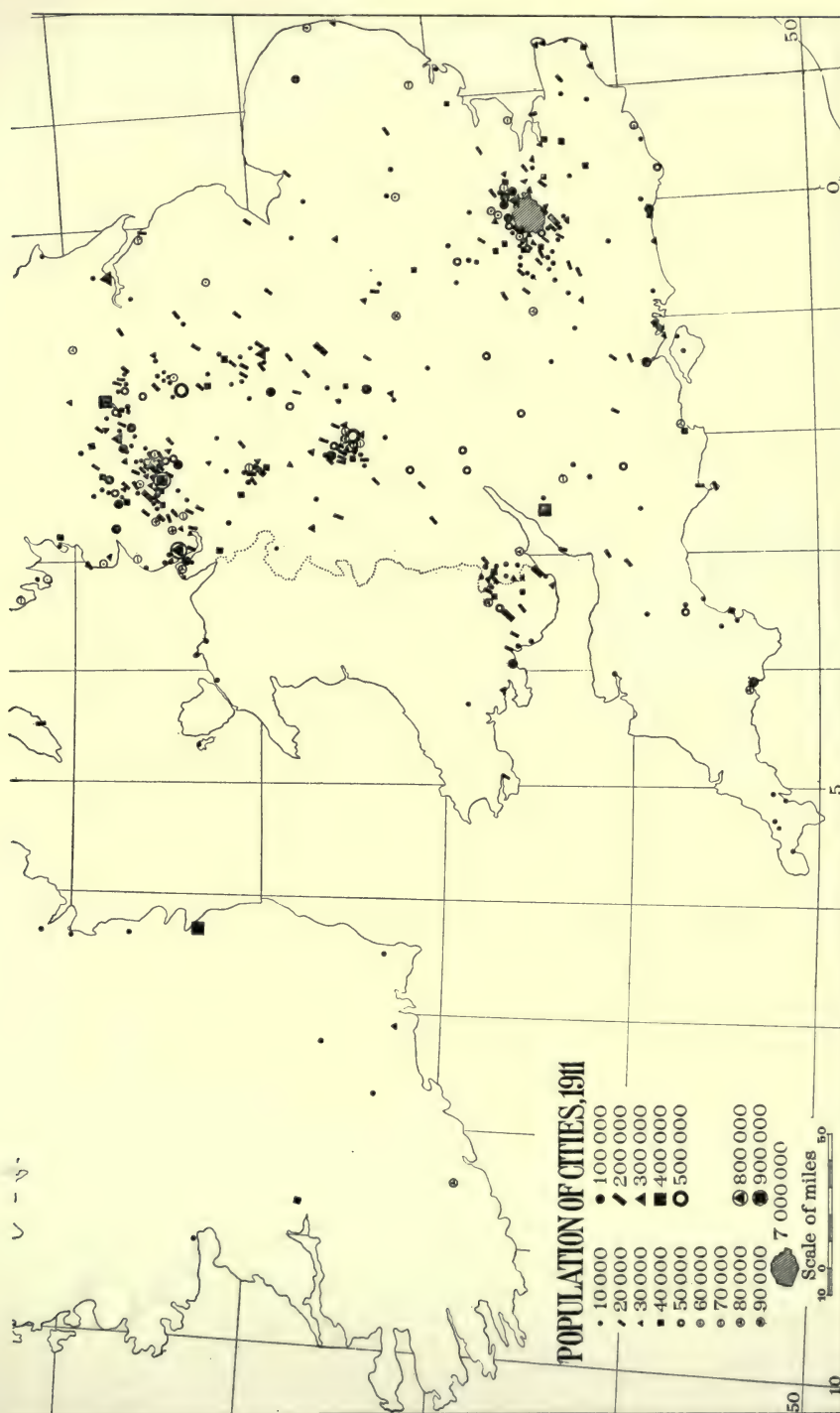


FIG. 1.—Outline map of the British Isles showing the location and size of all cities with a population of 10,000 and over. Scale, 1:4,500,000. The map strikingly illustrates how the cities of Britain swarm on the coalfields (for location of coalfields, see Fig. 2). No other country has anything to equal it.

the coal, or 4 per cent. Of 533 cities in the United States above the 10,000 size, 111 stand on the great coalfields. There is a single little swarm of 18 on the Scranton anthracite field. The 111 may be divided into five groups, 18 on the anthracite, 42 on the Appalachian, 7 on the Michigan, 21 on the Illinoian, and 13 on the Missourian fields. None of these but the Scranton group has any semblance of a swarm. It would not be possible at all to infer the location of any of the other fields from any concentration of the cities on the map. The coalfields have not really controlled the location of most of them. In the Michigan field, for instance, are Bay City, Saginaw, Flint, Owosso, Lansing, and Grand Rapids, and only the first two burn any Michigan coal. The only large city among them is Grand Rapids, which gets all its coal from outside the state. At the most one can say that 20 per cent of our cities are on coalfields, and 3 per cent (18 cities) show perceptible concentration there.

The United States and Germany may be said to use coal for manufacturing, but of England we must say that her coal treasures drove her to manufacturing, and the marketing of the product created her empire.

As an empire, the British Empire happened without anyone's intention, but there were geographic, as well as racial and moral forces behind the events that brought it into being. Official name it has none. The United Kingdom of Great Britain and Ireland has a parliament that regulates affairs in the British Isles and the dependent parts of the Empire. Other parts govern themselves absolutely. One calls it all England, nine times out of ten, England had so dominant a part in making the empire. However much an Irishman, a Scot, or a Welshman might be annoyed to be called English, he would never dream of claiming the Empire as Irish, Welsh, or Scotch. Today there are 34,000,000 English, 5,000,000 Scotch, 4,000,000 Irish, and 2,000,000 Welsh: three times as many English as all the others together. Men of all three races have made splendid contributions to the story of England, but it remains withal an English story.

There was room enough on the fertile plains of southeastern Britain to support an abundant population from the home soil. It is the best part of the kingdom agriculturally, but its crowning advantage as the home for a nation is its separation from the north-central plains of the Continent by the Channel's "silver strand," which saved it from the incessant invasions that have been the fate of every part of the plain on the mainland. England had its early invasions, Roman, Danish, Saxon, and Norman, but for long centuries now no invader has crossed the channel. Through this period the English nation has developed its independence, created its factories and the mechanisms for manufacturing and for transportation on land and sea, has won the lordship of the sea paths, and fared forth on them to the ends of the earth with the wares of its factories. These wares and this trade have needed the Empire, and, needing it, have created it.

The Empire is new. In 1600 England was not even united with Scotland or Ireland. Beyond the English border only Wales and the Channel Islands were owned, though there were pale beginnings of settlements in Newfoundland. But England had fought the Invincible Armada and won

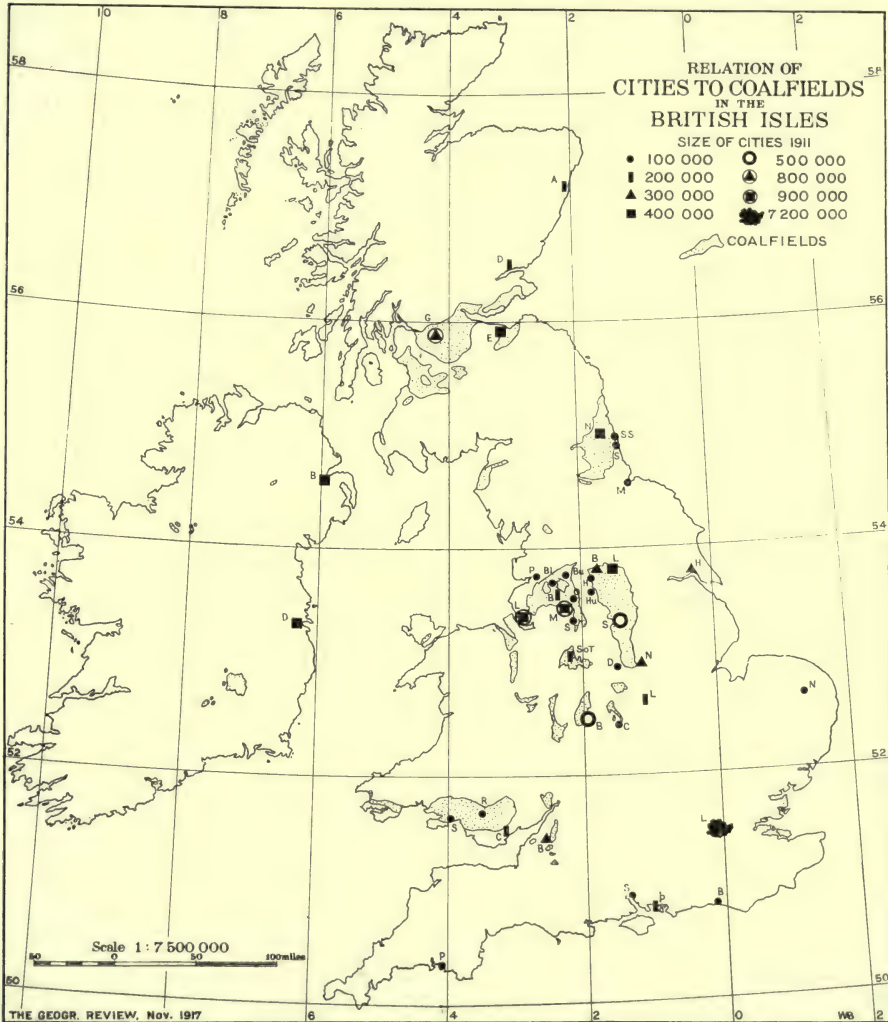


FIG. 2—Outline map showing the relation of cities to coalfields in the British Isles. Scale, 1:7,500,000.

from it the mastery of the sea. Her beginnings were made. A century later all Britain and Ireland were united, colonies extended along the American coast from Maine to Georgia, and Bermuda, the Bahamas, Jamaica, Antigua, and Barbados in the West Indies were all English. Moreover, firm foundation had been laid for an Indian Empire in the three commercial settlements at Calcutta, Madras, and Bombay.

Probably English character was powerfully influenced toward independence by the long freedom of English soil from foreign invaders. Not even the tradition of foreign soldiers burning, destroying, and ravaging on English soil exists. It is a striking fact that through the period of the Napoleonic wars, when French armies entered every town in Belgium, Holland, and northern Germany, the Channel and the English fleet kept England uninvaded, precisely in the years when the mechanical improvements in spinning and weaving, and the invention of the steam engine and the locomotive, introduced the industrial revolution. For these inventions all European industry was ripe, but only England had peace and tranquillity at home to develop them. In that last half of the eighteenth century England annexed eleven important colonial tracts, six and a half million square miles in all. In the first quarter of the nineteenth she added ten more tracts, measuring another quarter of a million square miles. Meanwhile France, who had made her colonial beginnings in the Antilles and India in the seventeenth century, added nothing from 1700 to 1830.

In the English development the flag followed English trade. Trading companies or individual traders prepared the way unwittingly for the great empire of today. One can hardly doubt that the impulse behind all this trade was the increasing product of English factories in an epoch when industrial progress was impossible to the war-harried peoples of the Continent. Napoleon's ambition for a continental empire had for its chief result the establishment of English manufactures, English trade, and the English empire beyond the seas. Today, when all the world is entering the commercial arena, when Germany and the United States are drawing close to British achievements, Britain is greatly sustained by the powerful momentum of her start and the possession of her Empire.

This conception of the British Empire as the direct result of English trade in English manufactures, which in turn are largely a response to English treasures of coal and iron, is strongly re-enforced by the distribution of her great cities. It has been said above that of the 40 cities with more than 100,000 inhabitants 27 stand on the coalfields. Twelve are seaports, and Norwich, a single one of the forty, is neither seaport nor coalfield town. The United States has 2 on its coalfields, while 35 like the English Norwich are distant from both sea and coal. Over against Germany's 11 cities on the Ruhr coalfield are 36 great German cities away from coal and sea. Cities of this size are the great foci of the nation's activities, and the English cities characterize England's occupations as industrial and commercial to a degree that is quite unique, as this contrast to her only trade rivals shows.

Modern civilized life is really based on the tilling of the soil. The activities of those who till the soil demand and create certain centers in which live people mainly occupied in exchanging and elaborating the products of the country soil and providing tools and necessities for the country dwellers.

These centers may consist of a few houses and a store at a country cross-roads, or they may be a village, a town, a city, a metropolis. Village and city workers are engaged in tasks that aid and prosper life in the country; and the plowing of country furrows, the reaping of country crops, the milking of country cows is of great importance to the city, is motivated much of the time by things that happen within the city. The city is the creature of the country and cannot live without it. The city dweller knows that only in the country can he buy his food. He is not so well aware that without the country he would have no money to buy it with. Such is a normal relation of a city to the countryside about. The English cities are unique in that they have taken the whole world for their countryside.

On the coalfield of the Scottish Lowlands stands Glasgow, the greatest ship-manufacturing city in the world. The Newcastle coalfield has on it Newcastle, South Shields, and Sunderland. In the Midlands fields of Lancashire, Yorkshire, and the Black Country are twenty great cities within a sixty-mile radius.² The South Wales field sustains Swansea, Cardiff, as well as the municipalized Rhondda valley. The blank spaces between these city groups and the seacoast are the most striking feature of the map. In all these cities coal drives the wheels of industry to a degree far beyond any local or English needs. They are not merely centers that respond to the manufacturing, assorting, and exchanging needs of their countrysides, but they stand each on a coalfield that supplies power and they use it to produce goods destined to go forth on the ocean to find such market as they may. They are manufacturing towns only. It is thus that manufacturing has become the mainspring of England as of no other country. It is customary to say that "England has not room enough to raise all the products necessary to feed and clothe the people and make them comfortable." This is a misconception of the life of a manufacturing nation. England does not resort to manufacturing because she has not room enough to raise crops to feed and clothe her people. She was doing both adequately in the middle of the eighteenth century; she took to manufacturing because it was more profitable and quickly found it cheaper to buy raw productions in new countries than to raise them at home. The wealth that came to her from marketing her wares and from owning ships made it easy for her to buy food wherever she found it. Probably there is no place in the world so well stocked with the products of all the nooks and corners of the earth as London. But this condition was not studied out or planned by the English. The English people liked factory work better than farm work, just as Americans and Germans have come to do. In the twenty years preceeding 1913 the cultivated area under the principal crops in the United Kingdom had diminished by 9 per cent, while in the United States it had

² They may be easily picked out on Figure 2 by their initials. Named in order from left to right and from top to bottom for each of these three regions, they are: Preston, Blackburn, Burnley, Bolton, Oldham, Liverpool (with Birkenhead), Manchester, Stockport, Stoke-on-Trent, Bradford, Leeds, Halifax, Huddersfield, Sheffield, Derby, Nottingham; Birmingham, Coventry, Leicester.

increased by 47 per cent. England has steadily abandoned tillage of her own lands as she found it easier to get crops from across the sea in exchange for her manufactures. The great parks of untilled English land attest the wealth of a nation that can hire its farm labor done cheaply in other countries.

London stands between the busy coalfields and the markets of the European mainland, the world's greatest manufacturing and commercial city, a city that has made the whole world its countryside. No wonder a fourth part of the world is the British Empire!

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Opening of the Lecture Season. The lecture program of the Society will open at eight-thirty o'clock on November 20 with an address by Mr. Donald B. MacMillan on the geographical work of the Crocker Land Expedition, of which he was leader. It will be recalled by readers of the *Geographical Review* that this expedition left for its base camp at Etah, Greenland, in 1913; that its main object was to explore Crocker Land; and that three relief expeditions in successive years were required to get the members safely home. The last relief ship, the *Neptune*, was commanded by Captain Robert A. Bartlett, to whose able seamanship is due the safe passage of the expedition through the extraordinary ice fields that marked the summer of 1917. The story of the expedition is of exceptional interest, for, though "Crocker Land" was found to be only a mirage, many valuable scientific results were secured by heroic perseverance in the face of great hardship.

Death of Mr. Henry Parish. Mr. Henry Parish died on September 18. Up to the time of his death he maintained an active interest in the Society, which dated from his election to Fellowship in 1872. He was a member of the Council for many years and was Chairman of it from 1895 to 1906, retiring only by reason of advanced years. He was consistent and broad in his care for the interests of the Society, supporting it with his means and by active personal effort. He was especially interested in the various Arctic expeditions to which the Society lent its sanction. During the period of his connection with the organization he saw it develop from a modest institution at 29th Street to its present extensive field of usefulness in its beautiful building at 156th Street, to the erection of which he contributed. His activities on behalf of the Society form only one of many works of public usefulness on his part which have stamped his memory as a worthy public-spirited citizen of New York.

Death of Councilor Charles Harrison Tweed. The Society is called upon to record with deep sorrow the death of its Councilor, Mr. Charles Harrison Tweed, who died on October 11. He had been for many years a Fellow of the Society and found time in the midst of an unusually active career to give counsel and help to the affairs of the American Geographical Society. His judgment was always accurate and his advice most valuable. His support of the active administration was constant and loyal. His associates and fellow Councilors share with a large circle of friends the sorrow occasioned by his decease.

NORTH AMERICA

Sign Posts in the Western Deserts. The gold rush of '49 involved the use of almost every available western trail. Men went by thousands into an untried wilderness, and through a heavy toll of life the worst desert places acquired a sinister fame. With better knowledge of the ground water and the location of springs, and with the building of railways, the dangers were diminished. This does not mean that the arid region of the West has been conquered. Much of it is still forbidding and some of it dangerous to cross. The desert still surprises the over-confident traveler.

The plan of erecting sign posts which will further diminish the dangers of desert travel is now actually under way. In 1916 Congress authorized the Department of the Interior to "develop, protect, and render more accessible for the benefit of the general public, springs, streams, and water holes on arid public lands of the United States; and in connection herewith to erect and maintain suitable and durable monuments and sign-boards at proper places and intervals along and near the accustomed lines of travel and over the general area of said desert lands, containing information and directions as to the location and nature of said springs, streams, and water holes, to the end that the same may be more readily traced and found by persons in search or need thereof; also to provide convenient and ready means, apparatus, and appliances by which water may

be brought to the earth's surface at said water holes for the use of such persons; also to prepare and distribute suitable maps, reports, and general information relating to said springs, streams, and water holes, and their specific location with reference to lines of travel." But, unfortunately, funds were not provided until 1917, when \$10,000 was appropriated. The U. S. Geological Survey is in charge of the work, which is still in the preliminary stage.

From Mr. George W. Parsons, a Fellow of the Society, there has been received an interesting collection of photographs, clippings, and memoranda showing the progress that has been made in the desert sign-post movement, of which he is the author.

The Aboriginal Culture Areas of North America. Recent discussions and reports on the physiographic divisions of North America and especially of the United States have aroused a fresh interest in the bases of such classifications. Two papers appearing originally in the *American Anthropologist* and the *Journal of American Folk-Lore* and reprinted in a volume of similar studies (Anthropology in North America, G. E. Stechert & Co., New York, 1915) present subdivisions of the North American continent based on the culture and traits of its ancient inhabitants. These classifications reverse the process used by the geographer and take the resultants as the unit rather than the underlying causes. The first paper (Areas of American Culture Characterization Tentatively Outlined as an Aid in the Study of the Antiquities, by W. H. Holmes, pp. 42-75) divides North America into sixteen cultural areas, eleven excluding Mexico and Central America, viz.: (1) the North Atlantic area; (2) the Georgia-Florida area; (3) the Middle and Lower Mississippi Valley region; (4) the Upper Mississippi and Lakes region; (5) the Plains and Rocky Mountains; (6) the arid region [of the Southwest]; (7) the California area; (8) the Columbia-Fraser area; (9) the Northwest Coast area; (10) the Arctic coastal area; (11) the Great Northern-Central area. The classification by many museum directors of archeological material according to present political divisions has its analogy in geography in the use of the state or group of states as the unit of study. This policy has the same disadvantages in archeology as was found in geography, and the movement towards cultural regions in anthropology has the same necessity which hastened the wide adoption of regional geography. Holmes' divisions, tentatively suggested, are based on the clearly manifested phases of their culture content. It is recognized that the boundaries are at times not well defined, that cultures overlap and blend along easy lines of communication, and that the extension of knowledge may and probably will cause the shifting of the boundaries. The cultural divisions as illustrated on the map appended to the paper have certain agreements with some of the studies of physiographic provinces in North America (see W. L. G. Joerg: The Subdivision of North America into Natural Regions, *Annals Assoc. Amer. Geogr.*, Vol. 4, 1914, pp. 55-83), and the conclusion is forced upon the archeologist that the relations of environment to man and culture must play an important part in the prosecution of his researches.

The second paper (Material Cultures of the North American Indians by Clark Wissler, pp. 76-134) follows somewhat the same lines of procedure as the preceding paper. Wissler's map shows but nine cultural areas north of Mexico, as follows: (1) the Eastern woodland area; (2) the Southeastern area; (3) the Plains area; (4) the Southwestern area; (5) the California area; (6) the Plateau area, (7) the North Pacific area; (8) the Mackenzie area; (9) the Arctic area. It thus essentially differs from Holmes' classification only in making two subdivisions east of the Great Plains where Holmes uses four. In describing the culture areas, Wissler states that each tends to have well within its borders a group of tribes whose cultures are quite free from the characteristic traits of other areas. As the spread of characteristic cultures is in this case also the basis of the cultural provinces, it is expectable that these should in the main be the larger geographical provinces. This paper enters into a greater detail of description than the preceding one and with many examples illustrates the theory of trait associations and the diffusion of material traits. In his conclusion, Wissler suggests that the significance of the geographical environment as a localizer, associator, or carrier of material traits or as a factor making for the continuity of a trait is a problem well worth considerable study.

ROBERT M. BROWN.

The Potash Industry of the United States. In 1915 were made the beginnings of a domestic potash industry. In the first half of 1917, according to figures of the U. S. Geological Survey (*Press Bull. No. 335*, September, 1917), production had risen to 14,000 tons, valued at a sum approaching \$6,000,000. The principal sources of this output were natural salts and brines and kelp, respectively accounting for about one-half and one-quarter of the total; alunite, dust from cement mills and blast furnaces, miscellaneous industrial wastes, and wood ashes contributed the remainder. The greatest single source, supplying one-third, was constituted by the Nebraska alkali lakes, described

in the *Review* for January (Vol. 3, 1917, pp. 67-68). Such a production is not inconsiderable for a new industry, but it still represents only about 10 per cent of the normal annual consumption prior to the war. For a further increase we are now encouraged to look to the much-talked-of deposit of Searles Lake (for a description of the "lake", by Hoyt S. Gale, see *U. S. Geol. Survey Bull.* 530-L, 1914). Development here has been held back pending legislation on the status of potash-bearing lands. On passage of the bill now before the Senate the product of the new Californian source may make its appearance in the market.

Extension of the Eastern Forest Reserves. In line with the policy to extend the National Forests, especially about the headwaters of navigable streams, the Government announces (*Official Bulletin*, June 26, 1917, p. 6) that 51,916 acres have been approved for purchase in the White Mountains and the Southern Appalachians. These tracts are an extension of the acquisitions already noted (*Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 875-876, and *Geogr. Rev.*, Vol. 2, 1916, pp. 223-224). The purchase was made possible by the appropriation of \$3,000,000 voted by Congress on August 9, 1916, for the extension, during 1917 and 1918, of the forest reserves already formed under the Weeks Law. The total now acquired under the provisions of that law, including this last addition, amounts to 1,456,200 acres.

The Destructive Eruption of San Salvador Volcano on June 7, 1917. On June 7, for the third time within three-quarters of a century, the city of San Salvador was almost completely destroyed by earthquake shock. At the same time an outpouring of lava from the San Salvador volcano a few miles to the northwest laid waste much valuable coffee and maize land. Moreover, hot ashes carried by the wind over the mountain withered the beautiful plantations of the Santa Tecla Valley: "at least 35,000 quintals of coffee are lost, and probably 70,000 of sugar," writes a resident to the *Geographical Journal* (September, 1917). The volcanic and seismic phenomena are briefly described by Herbert J. Spinden of the American Museum of Natural History, who was present in San Salvador at the time (*Scientific American*, August 4, 1917). The first violent movement of the ground effected little damage in the capital city but caused heavy destruction in Quezaltepeque and other villages of the northern slope. Apparently this shock coincided with the opening of new vents on this side of the mountain. An hour or two later came the shock that ruined the capital. It is not improbable that the later movement represents a collapse of the crust following upon the withdrawal of lava from the interior. Prior to the eruption, slight tremors had been numerous for some days, and for several succeeding days shocks continued practically without cessation.

Earlier eruptions and other manifestations in this zone of active vulcanism are noted in a contemporary number of *La Nature* (No. 2287, July 28, 1917).

SOUTH AMERICA

The Geographical Results of Dr. Farabee's Explorations in the Amazon Basin. Published accounts are now available of Dr. Farabee's explorations in the Amazon Basin in 1913-1916 (W. C. Farabee: *A Pioneer in Amazonia: The Narrative of a Journey from Manáos to Georgetown*, *Bull. Geogr. Soc. of Philadelphia*, Vol. 15, 1917, pp. 57-103, with map, 1:1,200,000; *idem*, *The Amazon Expedition of the University Museum, Univ. of Pennsylvania Museum Journ.*, Vol. 7, 1916, pp. 210-244, Vol. 8, 1917, pp. 60-82 and 126-244). These make possible the presentation of the geographical results of the expedition in greater detail than in the note in the February *Review* (Vol. 3, 1917, p. 149).

In the course of the journey to the first of the four areas visited on the expedition, the Guiana highlands, the Rio Negro and its tributary, the Rio Branco, were followed, the grasslands and the southern forests of Guiana penetrated, and the Corentyn descended to its mouth. In the Guiana forests the expedition passed through territory beyond the limits of Schomburgk's explorations and among tribes to whom the white man was absolutely unknown. The Akarai Mountains, forming the divide between the Amazon and the Guiana streams and the accepted but undelimited boundary between southern British Guiana and Brazil, were crossed and recrossed and important observations made on the hydrography of the region. On the economic prospects of British Guiana Dr. Farabee says much of interest. The savannas of the interior plateaus are well suited for cattle raising. At present economic production is practically nil. Such cattle as are exported must find their way with the Brazilian beasts of the Rio Branco to Manáos:

there exists no road to the home market that otherwise could be found on the coast. Dr. Farabee endorses the opinion of every traveler in this part of the country—the need for a railroad to connect the interior with Georgetown. (Compare C. Clementi: *A Journey to Mount Roraima across the Savannah Highlands of British Guiana*, *Timehri*, Ser. 3, 1917, Vol. 4, and also the article on the same journey in the *Geogr. Journ.*, Vol. 48, 1916, and see the proposed interior railway shown on the official map of the colony, 1913). At Dada-nawa, the station occupied by the Government's Protector of the Indians, agriculture with irrigation was proving successful. The rainfall, approximating 60 inches per annum, falls almost entirely in June, but underground water is abundant, a steady east wind prevails, and "the windmill is all that is needed to make this a valuable agricultural region"—when communications are established. In the opinion of Dr. Farabee the upper basin of the Corentyn, now clothed with hardwood forest and apparently destitute of inhabitants, also offers a suitable field for colonization. Some day it will become valuable, and before this happens the sources of the Corentyn should be determined and the boundary with Dutch Guiana be delimited.

On his second journey Dr. Farabee proceeded up the Amazon to Iquitos and thence up the Ucayali to Cumaria, the head of launch navigation. Here no part of the terrain covered was new ground, but it provided a splendid field for the acquisition of ethnographical material, an important task in a region where the primitive life of the native is fast disappearing before the advance of civilization. Today on the larger streams of the rubber country the primitive is mingling with the modern in strange ways. On the Ucayali was seen "a dugout canoe fitted with an Evinrude gasoline motor and used by a Conebo Indian to bring rubber from the small rivers to the station."

The advent of the rainy season in southwestern Amazonia made practicable a journey up the Rio Purus to Senna Madureira, the capital of the Territory of Acre. Here rubber has been responsible for a rapid development. Since the Acre passed into Brazilian possession the capital of the district has appeared as a modern settlement, with tram-cars and electric light, with streets and schools, and with houses well built of North American lumber. Of the various modern improvements the recent installation of wireless telegraphy is one of the greatest boons to the rubber collector, for by it he is kept in touch with market prices of rubber and is no longer at the mercy of the trader from Pará. Along the Purus the expedition's ethnological investigations were pursued with some difficulty. Even during the dry season comparatively few "wild" Indians are seen on the main stream, from which they have been driven by the rubber gatherer and his local destruction of game; during the wet season Indian encampments are only to be found some days' journey in the interior. To secure the data collected on four little-known Arawak-speaking tribes several side trips had to be made into the flooded forest.

The last journey of the expedition was made up the Tapajoz to visit the Mundurucus, the "head hunters," so named from their practice of preserving the heads of their enemies, a custom also in vogue among the Jivaros and other Amazonian tribes. The area occupied by the Mundurucus, who were formerly found on the banks of the main river, is now diminished: they have retreated to the semi-desert interior west of the divide between the Tapajoz and the Xingú. Another interesting tribe surviving in the Tapajoz basin is the Apiacas. To many native tribes along the navigable waterways Amazonian transportation owes a great and unrecognized debt. The Apiacas have such a claim on Matto Grosso. During the Paraguayan war, when the southern route via the Paraguay river was closed to western Brazil, a northern road was opened via the Tapajoz, and on it the Apiacas were employed as cargo-men. Today a good deal of fine rubber is carried down the Tapajoz and here, as on other Amazonian streams, the expert native paddle is effectively supplemented with motive power. "The journey to Matto Grosso, which requires from four to six weeks in a loaded canoe with paddles, can be made in twelve days by the aid of a motor."

EUROPE

A Forecast of Coming Winters in Western Europe. Mr. C. Easton in a letter to *Nature* (August 30, 1917, pp. 524-525) calls attention to some of the results of his extensive statistical study of winter temperatures in western Europe. After showing the close correspondence of the Paris and Utrecht temperature observations with the historical data for the past 89 years, he carries his investigation of winter temperatures back to the year A. D. 759. In these 1,157 winters there is a periodicity of 45 and 89 years, which in some respects is quite striking. Dividing the 1,157 winters into thirteen

89-year periods and then totaling the cold and severe winters for each quarter of the periods, the following results were obtained: first quarter, 30 cold and 12 severe winters; second quarter, 22 cold and 7 severe winters; third quarter, 31 cold and 15 severe winters; fourth quarter, 11 cold and 2 severe winters. In other words, the chances are that only one of the last 22 winters in one of these 89-year periods will be very cold or severe; while three or four such winters may be expected in each of the first and third 22-year periods, and two in the second. "The chance that the last quarter of an 89-year period contains a smaller number of hard winters than the preceding and following 22-year intervals is 0.88." The author says: "So early as 1905 I pointed out that a series of warm winters might be expected in the following years, according to these statistics, and that the year 1917 marked the beginning of a new period of comparatively cold winters. Though it seems a matter of mere chance that exactly the winter of 1916-1917 turned out to be the first . . . really cold winter since 1895 in western Europe; nevertheless a change in the weather type about this time is in perfect agreement with the forecast." The author considers these periods "undoubtedly related to similar fluctuations in the sun's activity" and says that increased activity of the solar surface corresponds in general to earlier and colder winters in western Europe. "The forecast for the period 1917-1938, derived from these statistics, indicates at least two very cold and one severe winter; the average winter temperature for these twenty-two years being generally below the 89-year mean."

CHARLES F. BROOKS.

The Utilization of Imatra Fall, Finland, for Hydro-Electric Power. One of the few channels by which the Finnish Lake Plateau discharges its waters into the lowland below is the Vuoksen River. This river drains Lake Saima, one of the larger bodies of water at the southeastern margin of this lake-studded platform, into Lake Ladoga and thus descends from a level of 255 feet to one of only 16 feet above the sea. Where the river discharges over the moraine-covered lip of the granitic platform it forms the well-known rapids known as the Imatra Fall. The rapids themselves have a fall of about 65 feet in a distance of 1,060 feet, the river here narrowing abruptly from a width of 580 feet to 154 feet. Thus all elements for the development of a high degree of water power are here concentrated. Investigations made before the war as to the amount of electrical energy to be derived from this source had shown that sufficient power could be generated to meet all future requirements for lighting, street railways, and the electrification of railroads in southeastern Finland and the Petrograd district (Petrograd being only 93 miles in an air line from Imatra Fall). In addition the water power is available of various other rapids and falls along the course of the Vuoksen River. What the fate of various projects under way in 1914 will be after the war is over is hard to conjecture, but, as *Russia* (R. Martens & Co., New York) for August observes, there is every likelihood of an opening for foreign capital to assist in developing this highly important resource.

An Aërial Mail Service between Continental and Insular Italy. The establishment of aërial mail service between islands and their mainlands promises a peculiarly valuable aid to the facilitation of their problems of communication. In this country a service between Nantucket Island and New Bedford has been proposed (*Geogr. Rev.*, Vol. 2, 1916, p. 152) and is expected to be in operation shortly, but in this field we are forestalled by Italy. Already regular mail service exists between the mainland and the islands of Sicily and Sardinia (*Journ. Roy. Soc. of Arts*, August 3, 1917, p. 644). The one route connects Naples and Palermo and is covered in two and one-half hours. The other route connects Civitavecchia and Terranova-Pausania and the journey occupies an hour and forty minutes.

The inauguration of another aërial mail line in Italy is reported in the September number of *Flying* (Mario de Bernardi: The First Permanent Aero Mail Line, Vol. 6, 1917, pp. 684-685). This line connects Turin with Rome.

ASIA

A New Interpretation of the Indian Monsoon. Mr. B. C. Wallis, in an article entitled "The Monsoon" in two recent numbers of *Indian Education* (Longmans, Green & Co., London), holds that "the hypothesis which states that the southwest monsoon is due to the high summer temperature and low summer pressure over Central Asia must at present be regarded with suspended judgment, if not with considerable suspicion." Mr. Wallis bases his objections on alleged facts and a general state of mind. The facts are of four kinds. (1) "Along the west coast of the Deccan the wind

blows on-shore from the sea from the end of March onwards, yet the rains fall with conspicuous suddenness in June." The implication appears to be that we have a monsoon blowing on the Western Ghats from the southwest during April and May with no rain. This flatly contradicts what we have been taught hitherto. Herbertson (The Distribution of Rainfall over the Land, London, 1901) gives 2 inches of rain at the southern end of the Western Ghats as early as March, 4 inches in April, and 12 inches in May. Although 16 inches fall along the whole coast in June, Wallis' statement that the rains "fall with conspicuous suddenness in June" is not accurate. (2) "Similarly in Burma and Assam the on-shore winds from the Bay [of Bengal] precede the coming of the rains by weeks." No dates are given, and we can only set Mr. Wallis' statement against that of the climatologists. We note that the hills of Assam have 2 inches of rain as early as February, from which time the rainfall increases to 16 inches in May, when Burma joins in suddenly with 12 inches, *just as if* the monsoon had begun in May, as we have been taught. (3) "In the case of the Madras coast, the rains precede the trade winds in the north, and the winds last long after the rains have ceased, i. e. during January and February." The rainfall of the north Madras coast is given by Herbertson as 2 inches in May, increasing from that time onward till it is nearly 8 inches by the end of September, while a little back from the coast more than 8 inches fall. Beginning with October the rains are heavier along the coast referred to than just inland, and the northeast trades are stated by Herbertson to prevail. It is not true that the northeast trades precede the rains. As the northern Madras coast trends northeast-southwest, it parallels the northeast "trades," and rains on that coast are hardly to be referred to them. But in southern Madras, where the coast runs north and south, November sees heavy rains with the northeast winds. The rains of northern Madras are referred by Mr. Wallis as well as other writers to cyclonic storms from the Bay of Bengal. So the period of these rains does not depend on the period of the northeast winds at all. (4) "During July and August a strong wind sets from the southwest from the African side of the Arabian Sea on-shore on the coast of Sind. The monsoon as an on-shore wind is fiercest there, yet Sind is arid." A glance at Herbertson's map shows us Sind with 2 to 4 inches in July and in August, too, while all the other months have less than 1 inch there. Evidently the two months of "fiercest monsoon" are the only wet months Sind knows! But Sind is low and level, and it is not on low and level lands, especially when heated by a zenithal sun, that monsoon winds are supposed to yield their rainfall.

Mr. Wallis' state of mind appears to be a conviction that the monsoons, like other features of the weather at the bottom of the "troposphere," are controlled by happenings in the "stratosphere," 8 or 9 miles above. He admits that we do not know much about the stratosphere yet, but India is walled off from the rest of Asia by the Himalayas to the full depth of the troposphere.

But a most welcome note is Mr. Wallis' contention that too much generalizing from insufficient data is indulged in in customary teaching about climate. Simplicity is highly prized by all teachers and rightly, but nature is not simple but highly complex. Teachers should observe local climatic facts, he urges, especially the varied facts of rain and wind in different parts of India, and these facts will not fit in with a broad general scheme without much modification to local circumstances. It is hard at present to learn what the facts of the actual winds are in various parts of India. Blandford's "Climates of India" gives only generalities. You cannot learn from it even for Calcutta what winds prevail month by month and how often they are interrupted by other winds than the prevalent winds, nor what winds prevail when the rains are falling. Indeed facts about winds everywhere are difficult to ascertain, especially in connection with this important matter of rainfall. Our own Weather Bureau publishes nothing on this important matter. Prevalent winds are given but not the winds blowing during rain, which is for landmen the main interest in the wind. At Salt Lake City the prevalent wind is published as southeast, but all the heavy rains quoted from recent local records fell while the wind was mainly in the northwest, i. e., across Great Salt Lake to the city and the Wasatch just beyond. Buffalo, Chicago, Detroit, and San Francisco all have their prevalent winds in the southwest, but it must not be assumed that their rains come with southwest winds.

We should get a clearer idea of the rainfall of India as well as of that of Florida, if the wind during rain were published, and it is to be hoped that Mr. Wallis' plea to the teachers of India will induce them to put on record what the official meteorologists have not usually published.

MARK JEFFERSON.

India's Coal Supply. The war has forced India to depend upon her own supply of coal and has drawn attention anew to her large deposits. For the last ten years her output has been gradually increasing as a consequence of the extension of railroads and

the development of industries. War conditions have accelerated this increase. The manufacture of munitions and the difficulty of securing coal from outside sources brought her production in 1915 up to more than 17,000,000 tons, a million tons more than in 1913 and more than double the amount she produced in 1905. She now not only supplies her own needs but exports to Ceylon and the Straits Settlements. India's coal deposits are scattered well over the east-central part of the country. In Assam, where the collieries at Margherita and on the Namchik River are working, there is a large field whose reserve is calculated at several billion tons. All these are Mesozoic and Tertiary beds. In Bengal and the recently created province of Bihar and Orissa are found the deposits that, at present, yield the greatest amount—over ninety per cent of the entire output. The best producing fields here are those of Raniganj and Jherria, the former in 1915 yielding 5,485,000 tons, the latter 9,141,000. Both of these fields contain large reserves, that of the former being estimated at 22,000,000,000, of which 518,000,000 are first-class coal. The Jherria field falls little behind these figures. The Giridih field, lying not far to the north, is not so well explored but has very large deposits.

In Central India and the Central Provinces few mines are actually being worked, but large quantities of good coal have been recognized, while in the Godavari basin, extending from near the coast along the Godavari River, important reserves are believed to be probable.

As the coal measures of Bengal and the province of Bihar and Orissa also contain clay ironstones and lie, generally, in territory that can be easily reached from the coast or are near important centers of industry, their value to India will probably increase very greatly as her industrial life develops.

Up to the present time the labor supply for the mines has been derived largely from the agricultural population. The farmers from the mountainous country of Chota Nagpur and the Central Provinces till their lands and reap their harvests still but migrate to the coal regions between times, somewhat as the Chilean laborers go north to the nitrate fields in winter and back to the farms of Central Chile in the summer season. This is a rather unsatisfactory supply for mining labor. It will probably change, and coal mining will become the regular occupation of a population at the coalfields.

The *Journal of the Royal Society of Arts* for June 22, 1917, quoting from the *Pioneer Mail*, summarizes the "Report on the Production of Coal in India" recently issued by the Department of Statistics. A description of the coalfields of India may be found, too, in "The Coal Resources of the World" prepared for the Twelfth International Geological Congress, Canada, 1913, while a more detailed account of the various fields is contained in a treatise on the "Coal Fields of India" by R. R. Simpson in Vol. 41, Part I, of the *Memoirs of the Geological Survey of India*, Calcutta, 1913.

Aden, the Emporium of Southwestern Arabia. The British district of Aden has become, in recent years, a distributing center for merchandise between Bombay and Suez, as well as from the Persian Gulf and Arabian and East African ports. At Aden the trader from Mombasa or Madagascar rubs elbows with Malabar Hindus, Bushire Persians, and desert Arabs. Although the war has interfered with the business of this trade center, its commercial exchanges with foreign parts are on the increase. Trade between Aden and America is growing and promises to become important. This lends interest to a recent report on the district by Consul Addison E. Southard published as *Supplement No. 49a to Commerce Reports* for May 7, 1917.

The local consumption of goods is insignificant. But as a center through which important markets can be reached, Aden is very advantageously situated. Its harbor is wide and commodious, being four by eight miles in area and providing anchorage for steamers drawing as much as 32 feet. The cargoes discharged at Aden are distributed over a large part of southern Arabia between the Red Sea and the Persian Gulf. They find their way to the Italian colony of Eritrea, to Abyssinia and the French colony of Jibuti, and to Somaliland. From all these centers a large quantity of merchandise is sent in return to Aden. Through Jibuti come cargoes of Abyssinian hides and coffee. The products of the Yemen and Hadramut rearlands are borne on camels, pack caravans reaching Aden daily. Thus a wide area of southwestern Asia and northeastern Africa is dominated commercially by Aden. In addition the district is a coaling station of prime importance and an advanced outpost of the Indian Empire.

HUMAN GEOGRAPHY

Graphic Representation of the Effect of Climate on Man. The admirable work of Dr. Griffith Taylor upon the climate and crops of Australia has already been reviewed

in the *Geographical Review* (Vol. 1, 1916, p. 396). He has now published a still more interesting paper on "The Control of Settlement by Humidity and Temperature" (*Commonwealth Bur. of Meteorol. Bull. No. 14, Melbourne, 1914*). Although the

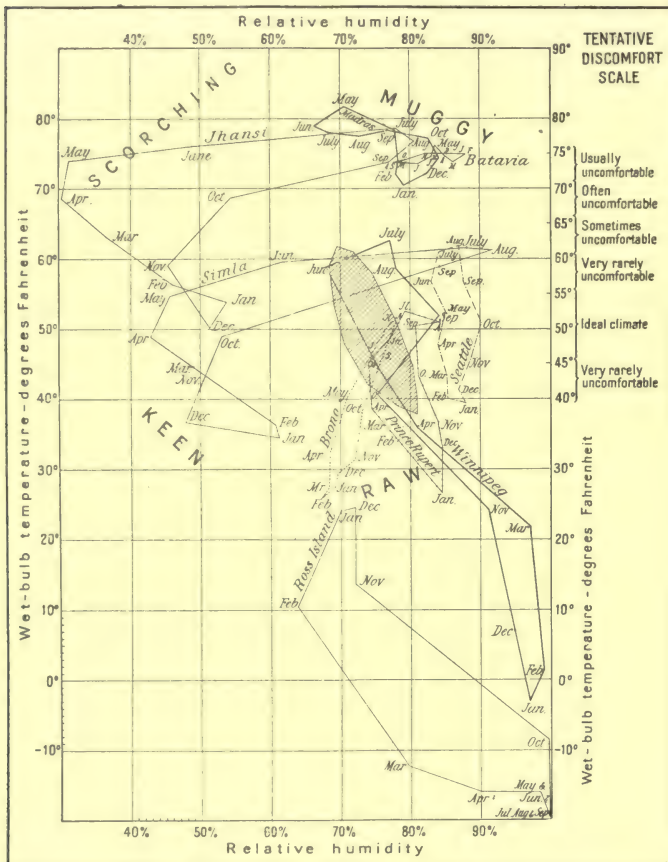


FIG. 1—A "climograph" of nine different places, affording a criterion as to the effect of their climates on man. The places are: Batavia, Java; Madras, Jhansi, Simla, India; Seattle, Wash.; Brönö, Norway ($65\frac{1}{2}^{\circ}$ N.); Prince Rupert, B. C.; Winnipeg, Man.; Ross Island, Antarctic (78° S.). (Redrawn from Fig. 9 of Griffith Taylor's "The Control of Settlement by Humidity and Temperature.")

A "climograph" is a graph in which the twelve monthly mean values of wet-bulb temperatures and relative humidity at a given place are plotted as a twelve-sided polygon. The shaded polygon is a composite climograph and represents ideal conditions for the white race.

bulb temperature as the two chief climatic criteria and draws a series of figures one of which (Fig. 9, opp. p. 20) is here reproduced.

His method is unique and so valuable that it ought to be widely understood. The ordinates of the diagram represent relative humidity, and the abscissas the wet-bulb temperature. On the basis of these two criteria a point on the chart is located for a given place for each month. Then the months are connected in their proper order, thus giving a closed figure whose lines may or may not cross. Four extremes are possible, as is indicated by the words "scorching," "muggy," "raw," and "keen" in the corners of the diagram. In order to find the ideal conditions as nearly as possible, Dr. Taylor chooses twelve large cities in regions where the white man prospers. Five of these are in the southern hemisphere, namely, Sydney, Perth, Hobart, Capetown, and

paper applies primarily to Australia it touches upon all parts of the British Empire and upon many other countries. Dr. Taylor's purpose is to discover whether there is ground for the hope that Australia may ever become a genuine white man's country, that is, a country densely settled by members of the white race. In pursuit of this object he first gives us some excellent maps showing the mean range of temperature in Australia between the hottest and coldest months and the mean humidity of the continent for each month. He then proceeds to develop what he has called the "climograph." Like many other recent students he is convinced that humidity is as important as temperature. If a climate is to be represented by only a single set of monthly numbers, the wet-bulb, or "sensible," temperature comes nearer than anything else to showing how man is affected. Accordingly he selects humidity and wet-

Johannesburg, and seven are in the northern hemisphere, namely, London, Aberdeen, Berlin, Toronto, New York, Chicago, and Seattle. From the average monthly figures for these twelve he prepares a "composite white climograph," which is shown by the shaded area in the diagram. He assumes that the conditions thus represented are close to the ideal. New Zealand, England, and the Puget Sound region come nearest to this ideal. This result agrees closely with the conclusions of the reviewer, based on a wholly different method, a fact which Taylor brings out forcibly.

While the general value of Taylor's method cannot be doubted, one special point leaves room for question. By using the wet-bulb temperature and the relative humidity he seems to have given double weight to humidity. The wet-bulb temperature is in itself an expression of the amount of moisture in the air. Its chief value consists in the fact that it enables one to describe the effect of a climate by means of a single set of figures or a single curve. If two sets of figures are used and diagrams are drawn in two dimensions the actual temperature and the humidity would seem to be the ones that should be chosen. The use of this method is illustrated by W. D. Pierce in his paper on the boll weevil (*A New Interpretation of the Relationships of Temperature and Humidity to Insect Development*, *Journ. Agric. Research*, Vol. 5, 1916, pp. 1183-1191). His diagram is here reproduced. By a long series of experiments Pierce determined the death-rate of the weevils under various conditions of humidity and temperature. He was thus able to locate a central or optimum area where the insects thrive vigorously. Around this area he was also able to draw concentric lines showing the degree to which the weevils are weakened, and the conditions under which they become dormant and finally die. He suggests that a similar diagram might well be drawn for man. As visual representations of the various effects of climate, however, Taylor's diagrams are much the best yet available.

ELLSWORTH HUNTINGTON.

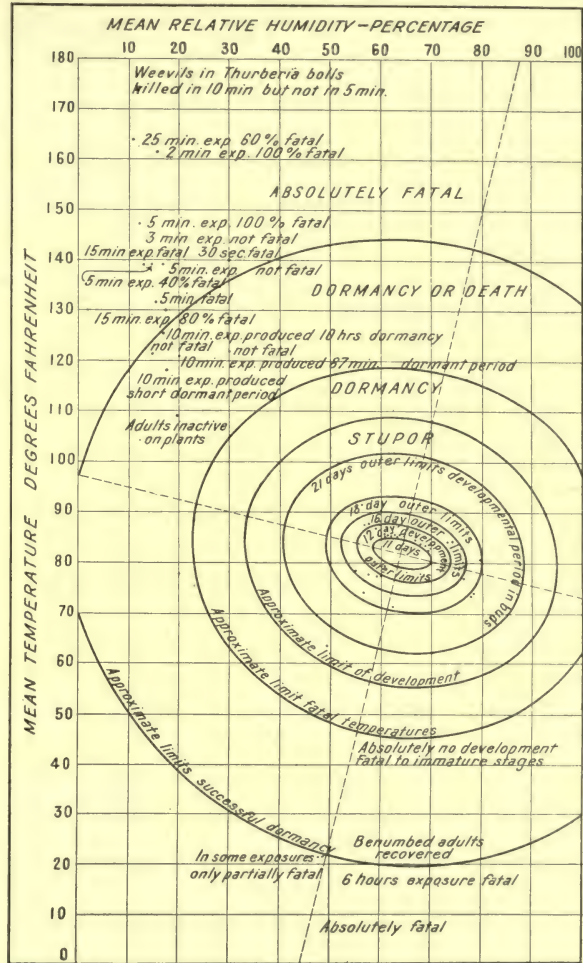


FIG. 2—Graph showing the relations of temperature and humidity to cotton boll-weevil activity. (Redrawn from Fig. 1 of the paper by W. D. Pierce mentioned in the text.)

GEOGRAPHICAL NEWS

Free Geographical Material. The May, 1917, number of the *Journal of Geography* is devoted to the useful object of presenting a fairly complete list of geographical publications that may be obtained free or at small cost. There is an introductory discussion

followed by a general list arranged in alphabetical order by countries. This is followed by a list of references on industries and commercial products, a miscellaneous list, a compilation of educational exhibits, and a list of addresses of dealers in geographical supplies. The whole number is one which every teacher of geography should have at hand and is especially valuable for the isolated school where appropriations for supplies are exceedingly limited. The above list is taken from a more complete list of geographical material published by the Eastern Illinois Normal School, Charleston, Ill., and sent free of charge to those applying to the school for it.

PERSONAL

PROFESSOR W. M. DAVIS of Harvard University read a paper on April 14 before the American Philosophical Society of Philadelphia on "Uplifted and Dissected Atolls in Fiji."

DR. W. C. FARABEE of the University of Pennsylvania, whose recent explorations in South America have been the subject of a lecture before the Society and of several notes in this *Review*, read a paper before the American Philosophical Society of Philadelphia on April 14 entitled "The South American Indian in His Relation to Geographic Environment."

MAJOR-GENERAL GEORGE W. GOETHALS read a paper before the American Philosophical Society of Philadelphia on April 14 on "The Slides on the Panama Canal."

DR. J. PAUL GOODE of the department of geography of the University of Chicago has been promoted from an associate professorship to a professorship in the department.

MR. HARVEY D. GOULDER, General Consul for the Lake Carriers Association, addressed the American Association of Port Authorities at Cleveland, Ohio, on September 11, on "Water-borne Traffic on the Great Lakes."

DR. ELLSWORTH HUNTINGTON gave a lecture before the Geographic Society of Chicago on October 26 entitled "The Turks and the Euphrates."

MR. ROBERT B. MARSHALL of the U. S. Geological Survey, as a major in the Engineer Officers' Reserve Corps, is at present engaged in military mapping for the War Department.

DR. FRIDTJOF NANSEN, who has been in this country since July 26 as Minister Plenipotentiary of Norway on Special Mission, addressed the Food Conference held on September 14-15 in Philadelphia at the American Academy of Political and Social Science.

DR. H. F. REID of Johns Hopkins University read a paper on "The Distribution of Land and Water on the Earth" before the American Philosophical Society of Philadelphia on April 14.

PROFESSOR BERNARD H. SCHOCKEL of the department of geography and geology in the Indiana State Normal School has taken a leave of absence to complete his course of study in Chicago University. His work at Terre Haute will be carried on by Dr. Charles R. Dryer, whom he succeeded in 1913.

DR. W. S. TOWER of the department of geography of the University of Chicago has been promoted from an associate professorship to a professorship in the department.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

Western States

LA RUE, E. C. **Colorado River and its utilization.** 231 pages; maps, diagrs., ills., bibliogr., index. *U. S. Geol. Survey Water-Supply Paper 395*, Washington, D. C., 1916.

For some years the U. S. Geological Survey has been publishing in great detail the results of its hydrographic studies of the various river systems of the country. Nineteenth of these publications have been technical or statistical in character and present little variation in the mode of treatment. In this paper we have a notable departure from the general scheme with the commendable result that the geographer finds in well-classified and readable form data of first importance in a study of the Colorado River. The report opens with an account of the physical features abstracted from Powell's "Canyons of the Colorado," published in 1895. Under "Explorations" are outlined and arranged in chronological order the various expeditions in and about the canyon from 1531 to 1911, with a condensed account of each.

A section on population gives the number of persons in the Colorado River basin in 1915 and the population of important cities. Some interesting comparisons between the Nile and the Colorado—area, length, total fall, irrigable land, mean annual run-off, and principal crops—increase the geographical value of the report. A useful bibliography of United States Government papers is included and will be appreciated by those attempting to master the growing literature on the Grand Canyon region. Instead of the cut-and-dried descriptions of the main stream and its tributaries usually found in reports of a similar nature we have a geographical description of considerable merit. Irrigation from the Colorado River is discussed in other sections, of which the most important is that dealing with the Imperial Valley project. Plate 14 and the accompanying text show an interesting diversion from the Green River basin to the Colorado basin. Of special interest is the section devoted to the adequacy of water supply for lands on the lower Colorado. It is estimated that the irrigable area below the Virgin River aggregates 2,730,000 acres. There are sections on the water-power developments, the magnitude and frequency of floods, and the amount of silt in the Colorado River. The maps are noteworthy. Plate 12, on the scale of 1:250,000, shows the drainage diversions for irrigation in the Imperial Valley and is the best large-scale map now in existence of the region between the mouth of the Colorado and the Salton Sea. Plate 20 shows the volume of discharge of the Colorado River and its tributaries by the device of a colored band increasing in width down stream, the width of the tint being proportional to the volume of discharge. Plate 13 shows reservoir and water-power sites, both developed and undeveloped, up to 1915 and also indicates the points of diversion from the Colorado drainage basin to neighboring basins. Plate 15 represents constructed and proposed diversions from the Colorado River basin to the Mississippi River basin.

If the U. S. Geological Survey could make similar studies of the other great river basins within our domain it would render an exceedingly important public service. There is in La Rue's report a quality missing from many of the other *Water-Supply Papers* and strongly reminiscent of Powell's "Arid Lands of the West" and Johnson's "High Plains and Their Utilization." *Water-Supply Paper 395* should become well known among geographical scholars.

TRIMBLE, W. J. **The mining advance into the Inland Empire: A comparative study of the beginnings of the mining industry in Idaho and Montana, eastern Washington and Oregon, and the southern interior of British Columbia, and of institutions and laws based upon that industry.** Map, bibliogr. *Bull. Univ. of Wisconsin No. 638 (History Series, Vol. 3, 1914, No. 2, pp. 137-392)*. Madison.

"The plan of presentation contemplates: (1) a survey of the history of the mining advance; (2) special treatment of its social and economic aspects; (3) consideration of

problems of government." The struggle with the Indians of the Northwest, the hardships suffered on account of the remoteness of the territory from permanent habitations, the consequent lack of an established social régime, the assortment of peoples representing almost every part of the earth's surface and possessed of a wide variety of experiences and inclinations—these were the great problems to be overcome by the pioneers of the "Inland Empire."

Emphasis is placed upon the fundamental fact that co-operation is essential to successful gold mining. The process of placer-mining, the method most commonly used in the early days, is described in some detail. The food supply was a cause of no little concern. Meat was apparently plentiful, but plant food was lacking. Hence agriculture was given early consideration. This in turn raised the question of how best to distribute the lands for farming. The details of that situation are presented briefly, with stress on the conditions in British Columbia. The influence of the large gold production in the Northwest during the Civil War, a time when the nation was hard pressed for money, is shown to have been momentous. The establishment of transportation routes to the east is described in a single chapter.

Returning, in a later chapter, to the people, under the caption "Components and Characteristics of Society," the author shows how large a rôle "enterprise" played as one of their most prominent characteristics. Nomadism among the miners was prevalent. Despite that fact, semi-permanent and permanent communities took root in many places.

Two chapters on "Law and Government" and a selected bibliography conclude the volume. It is to be regretted that so excellent a piece of work should be introduced with so poor a map.

EUGENE VAN CLEEF.

BENSON, H. K. **Industrial resources of Washington.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 353-356.

BERRY, SWIFT. **Lumbering in the sugar and yellow pine region of California.** 99 pp.; map, ills. *U. S. Dept. of Agric. Bull. No. 440.* Washington, D. C., 1917.

BRETZ, J. H. **The Satsop formation of Oregon and Washington.** Map, diagr. *Journ. of Geol.*, Vol. 25, 1917, No. 5, pp. 446-458. [Outlines the position and topographic (as well as stratigraphic) relations of the widely distributed Satsop formation and concludes that these indicate a Quaternary age for at least a considerable portion of the Cascade Range.]

BUCHANAN, J. E. **The Spokane country; Its industries and cities.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 356-361.

BURKE, EDMUND, AND R. M. PINCKNEY. **Temperature records, 1898-1913: An appendix to report on Montana climate.** *Montana Agric. College Exper. Sta. Bull. No. 99*, pp. 68-143. Bozeman, 1914.

BUTLER, G. M., AND G. J. MITCHELL. **Preliminary survey of the geology and mineral resources of Curry County, Oregon.** Maps, diagrs., ills., index. *Mineral Resources of Oregon*, Vol. 2, 1916, No. 2, pp. 1-134. Oregon Bureau of Mines and Geology, Corvallis.

BUWALDA, J. P. **Meteorological synopsis of Berkeley, (1) August, (2) September, (3) October, 1916.** (Second Ser., Vol. 5, Nos. 2, 3, 4.) 2 pp. each. Dept. of Geogr., Univ. of California, Berkeley.

CHAPMAN, C. E. **The Alta California supply ships, 1773-76.** *Southwestern Hist. Quart.*, Vol. 19, 1915, No. 2, pp. 184-194.

CHAPMAN, H. H. **The extension of National Forests in Colorado.** ills. *Amer. Forestry*, No. 283, Vol. 23, 1917, pp. 399-402.

CHITTENDEN, H. M. **A 30-mile railway tunnel under the Cascade mountains.** Maps, diagrs., ills. *Engineering News*, Vol. 76, 1916, Nov. 16, No. 20, pp. 928-935. [Abstracted in the *January Review*, p. 67.]

CLARK, W. O. **Ground water for irrigation in the Morgan Hill area, California.** Maps, diagrs. *U. S. Geol. Survey Water-Supply Paper 400—E*, pp. 61-105. Washington, D. C., 1917.

COCKERELL, T. D. A. **Colorado a million years ago.** ills. *Amer. Museum Journ.*, Vol. 16, 1916, No. 7, pp. 443-450.

— **Conquest of the desert, The.** ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 6, pp. 39-41.

COOPER, W. S. **Redwoods, rainfall, and fog.** Map, ill. *Plant World*, Vol. 20, 1917, No. 6, pp. 179-189.

CRANDALL, L. D. *The "Colonel Wright."* *Washington Hist. Quart.*, Vol. 7, 1916, No. 2, pp. 126-132. [The first steamship navigating the Columbia River, 1859.]

WEAVER, C. E. *Mineral resources of Washington.* *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 343-347.

YOUNG, R. F. *Relation of precipitation to stream flow in northern Rockies and incidental effects of temperature and evaporation.* *Reclamation Record*, Vol. 6, 1915, No. 6, pp. 266-267. U. S. Reclamation Service, Washington, D. C.

— [Colorado]: *Map showing the location of the Animas Power and Water Co.'s hydraulic developments, transmission lines, distributing circuits, etc.* 1 in. to 2 mi. (1:126,720). C. P. Gray, New York, 1916.

— *Coquille River, Oregon, entrance.* 1:10,000. *U. S. Coast and Geodetic Survey Chart No. 5971.* Washington, D. C., 1916.

— [Topographic map of the United States.] Sheets: (1) *Copperopolis*, (2) *Santa Rosa, California.* 1:62,500. U. S. Geol. Survey, Washington, D. C., 1916.

MEXICO AND CENTRAL AMERICA

WEBSTER, E. B. *Report on the northern district of Lower California; with special reference to the climate, water supply, and agricultural production, present and prospective, of the La Frontera subdivision of the northern district, and the mineral resources of the whole of the northern district, extended comparisons being made between the northern district, and especially between the La Frontera subdivision of the northern district, and southern California in the United States.* xxiii and 359 pp.; 12 maps in separate roll. Fry & Smith, San Diego, 1913. 9 x 6.

A curious and naive book. Probably also in some respects a useful book. Large portions of it consist of quotations from a lengthy "Report on Southern California"—not yet published. The endless references to this report—often three or four on a double page—remind one of the repetitions of the lama formula of Tibet *Om mani padme hum!* Questions are raised only to be dropped—as if an orator, after much gesticulation, sat down without beginning his speech. "It may be mentioned in passing that since the above quotation from the writer's report... was written, the question has arisen at the suggestion of the writer as to whether..." (page 191) is the preamble to the question whether the removal of the chaparral covering affects the run-off. "The movements of the permanent highs and lows bring rain to the Coast Region..." leaves one bewildered. When does a "high" bring rain? What information is conveyed by the phrase "...deductions made by the writer from personal examinations of the areas involved"? Doubtless a great many of the data, which include statistics about crops, irrigated land, farm values, and rainfall, are reliable; but in the nearly complete absence of reference to authoritative sources it is not possible to separate the accurate from the inaccurate.

Accompanying the report, though as a separate publication, are a set of maps, chiefly blue prints, showing the physical regions, the arable areas, river systems, and mineral deposits of the northern district of Lower California. They contain a large number of place names, and relief is shown roughly by hachures.

— *Beginning of work on the Honduran section of the Pan American railway.* *Bull. Pan American Union*, Vol. 42, 1916, No. 3, pp. 317-318.

— *Catálogos de los movimientos registrados durante el año de 1911 en las Estaciones Seismológicas de Mérida, Yucatán, Mazatlán, Sinaloa, y Oaxaca. Catálogo de los macroseismos sentidos en la República Mexicana durante el año de 1911.* *Parergones del Inst. Geol. de Mexico*, Vol. 5, 1913, No. 1-3, pp. 1-79.

DAGGETT, STUART. *The Panama Canal and transcontinental railroad rates.* *Journ. of Polit. Econ.*, Vol. 23, 1915, No. 10, pp. 953-960. Univ. of Chicago, Chicago, Ill.

DOMINIAN, LEON. *Glimpses of the Mexican's geographical background.* Ills. *Bull. Geogr. Soc. of Philadelphia*, Vol. 14, 1916, No. 3, pp. 81-91.

FRANCK, H. A. *Tramping through Mexico, Guatemala, and Honduras: Being the random notes of an incurable vagabond.* 378 pp.; map, ill. The Century Co., New York, 1916. \$2.00.

GALVEZ, VICENTE. *Las aguas subterráneas en los municipios de Acatlán y Jaltepec, distrito de Tulancingo, Estado de Hidalgo.* Map, ill. *Parergones del Inst. Geol. de Mexico*, Vol. 5, 1916, No. 10, pp. 429-475.

GILLPATRICK, WALLACE. *The man who likes Mexico.* xvi and 374 pp.; ill. The Century Co., New York, 1912. 8½ x 6.

HAGAR, G. J. **Plain facts about Mexico: The country, states and cities, the people, the resources, government, and statistics.** 80 pp.; map, index. Harper & Brothers, New York and London, 1916. 50 cents. 8 x 5.

LEDUC, ALBERTO, LUIS LARA Y PARDO, AND CARLOS ROUMAGNAC. **Diccionario de geografía, historia y biografía mexicanas.** viii and 1109 pp. Vda de Bouret, Paris and Mexico, 1910. 7 x 5.

— **Nicaragua, Trade of, in 1915.** *Board of Trade Journ.*, No. 1,028, Vol. 94, 1916, pp. 416-418. London.

ORDÓÑEZ, EZEQUIEL. **A short note on the oil fields of Mexico.** *Mem. y Rev. de la Soc. Científica "Antonio Alzate,"* Vol. 34, 1916, No. 4-9, pp. 121-127.

REID, H. F. **Note on the earthquakes at Almirante, Republic of Panama, in April, 1916.** *Bull. Seismological Soc. of America*, Vol. 7, 1917, No. 1, pp. 27-30.

REID, W. A. **Merida and Progreso: Yucatan's busy cities.** Ills. *Bull. Pan American Union*, Vol. 44, 1917, No. 2, pp. 161-173.

— **Salvador, El, Anuario estadístico de la Republica de correspondiente á 1914.** 159 pp.; ills. Dirección General de Estadística, San Salvador, 1915.

SANDBERG, H. O. **Central America of to-day—El Salvador.** Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 3, pp. 340-357.

SANDBERG, H. O. **Central America of to-day—Nicaragua.** Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 4, pp. 480-496.

SANDBERG, H. O. **Panama—to-day and to-morrow.** Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 6, pp. 745-762.

TRISTAN, J. F. **The Costa Rica earthquake of February 27, 1916.** *Bull. Seismological Soc. of America*, Vol. 6, 1916, No. 4, pp. 232-235.

YOUNGBLOOD, F. J. **A little journey in Honduras.** Ills. *Natl. Geogr. Mag.*, Vol. 30, 1916, No. 2, pp. 177-184.

WEST INDIES

WESTERGAARD, WALDEMAR. **The Danish West Indies under Company rule (1671-1754), with a supplementary chapter, 1755-1917.** With an introduction by H. M. Stephens. xxiv and 359 pp.; maps, ills., bibliogr., index. The Macmillan Co., New York, 1917. \$2.50. 8½ x 6.

This study is the result of an exhaustive research into the material of the Danish state archives and other original sources. In the introduction by Professor Stephens the geographic interest is anticipated. During the seventeenth and eighteenth centuries the West Indies, small islands of easily detached ownership, were a focus of political and economic interest for the nations of Europe. It may be recalled that the little French island of Guadeloupe was actually balanced against Canada in the negotiations at the conclusion of the Seven Years' War! The all-important motive was the sugar trade: "the European nation that could grow its own sugar cane and import its own sugar in its own ships had an immense commercial advantage over other countries." Dr. Westergaard's book may be looked upon as a history of the earlier days of sugar production in the Danish islands. A considerable part of it is devoted directly to this theme: the plantations are described, the life on them and the labor question, that great problem that confronted all the tropical colonies of America. Here geographic influences are revealed: witness such paragraphs as these on the planter's troubles with his slaves: "The chief means of communication between the more remote and inaccessible plantations and the harbor on the south side was by canoe. The mountainous character of the island and the torrential downpours to which it was subject rendered the making and repairing of roads a costly matter; but the numerous 'bays' with their convenient beaches lent themselves to the keeping of canoes and small sailboats When the slave-hunt in the bush became too successful, it is not strange that the hunted negroes, who were often proficient in handling the canoes, should take to the boats and pull for Porto Rico . . . , a promised land from which rarely indeed was a slave returned" (p. 160); and "The uprising of the slaves on St. John began late in November, 1733. During the spring and summer preceding there had been a long period of drought, followed in July by a destructive hurricane which had inflicted considerable damage upon the already suffering crops as well as upon buildings and shipping. A plague of insects had destroyed many of the products of the islands, and the negroes were threatened with famine. Another storm in the early winter was especially severe on the maize crop, on which the negroes largely depended for food" (p. 166).

The history of any West Indian island, however local and intensive, is inevitably

wrapped up to a peculiar degree with events of wider scope. Dr. Westergaard brings such broad relations into clear focus in his treatment of the Danish islands. One episode is worth recording here because it is both timely and little known. This is the incident of Prussia's first attempt to enter the colonial field. Under the Great Elector, Brandenburg-Prussia, without sea-power, attempted to secure a share in the Indies through the great sea power Denmark-Norway and for a time enjoyed a station on the island of St. Thomas.

To the earlier stage in the history of the islands is added a short chapter on the history subsequent to 1755. With this later period the author proposes to deal in two succeeding volumes: they will be waited with interest.

— **Agriculture, Report of the Director of, for the nine months ended on the 31st of December, 1915.** 54 pp.; diagr. Dept. of Agric., Trinidad and Tobago. Trinidad, 1916. [Includes rainfall statistics.]

— **American Gibraltar, An: Notes on the Danish West Indies.** Maps, ills. *Natl. Geogr. Mag.*, Vol. 30, 1916, No. 1, pp. 89-96. [States that according to planimetric measurements made in the office of the National Geographic Society on hydrographic charts (scale not given) the areas of the three major islands in square miles are as follows: St. Thomas, 28.25; St. John, 19.97; St. Croix, 84.25.]

BRITTON, N. L. **The Danish West Indies.** ills. *The South American*, Vol. 5, 1916, No. 1, p. 10. [Notes on the vegetation.]

BROCK, H. G., P. S. SMITH, AND W. A. TUCKER. **The Danish West Indies: Their resources and commercial importance.** 68 pp.; map, ills. *Bur. of Foreign and Domestic Commerce Special Agents Series No. 129.* Dept. of Commerce, Washington, D. C., 1917. [An authoritative official account of the resources and commercial possibilities of our newly acquired islands, on which several of the articles here listed are based.]

— **Cuba.** 80 pp. Guaranty Trust Company of New York, 1916. 7 x 5. [One of a series of pamphlets on foreign trade issued by this company.]

— **Cuban Number, Special.** ills. *The South American*, Vol. 4, 1916, No. 10 (= pp. 239-290).

— **Danish West Indies, The.** Map, ills. *Bull. Pan American Union*, Vol. 44, 1917, No. 2, pp. 189-200. [Spanish version in *Bol. Unión Panamericana*, Vol. 44, 1917, No. 3, pp. 350-361.]

— **Danish West Indies, The—Their strategic and commercial importance.** Map, ills. *Dun's Rev.: Internatl. Edit.*, 1916, Sept., pp. 47-50.

DELGADO, R. M. **Results of American administration in Porto Rico.** ills. *The South American*, Vol. 4, 1916, No. 4, pp. 77 and 90.

EMERSON, GUY. **The Virgin Islands of the United States: A description of the latest addition to Uncle Sam's vast dominion.** ills. *The South American*, Vol. 5, 1917, No. 8, pp. 5-8.

FORD, J. C., AND FRANK CUNDALL. **The handbook of Jamaica for 1916: Comprising historical, statistical, and general information concerning the island, compiled from official and other reliable records, Vol. 36.** viii, 642, and xii pp.; maps, bibliogr., index. Government Printing Office, Kingston, and Edward Stanford, London, 1916. 6s. 9 x 6. [Includes a brief bibliography of Jamaica. A full bibliography, *Bibliographica Jamaicensis*, was published by the Institute of Jamaica in 1902 and a supplement of it in 1908.]

GOODRICH, C. F. **Our navy and the West Indian pirates: A documentary history.** Bibliogr. *U. S. Naval Inst. Proc.*, No. 164, Vol. 42, 1916, pp. 1171-1192.

GUTIÉRREZ-LANZA, P. M. **Apuntes históricos acerca del Observatorio del Colegio de Belén, Habana.** iv and 178 pp.; ills. Imprenta Avisador Comercial, Habana, 1904. 9½ x 6½.

GUTIÉRREZ LANZA, MARIANO. **Conferencias de seismología pronunciadas en la Academia de Ciencias de la Habana.** xvi and 157 pp.; maps, diagrs., ills. Imp. y Librería de Lloredo y Ca., Habana, 1914. 10 x 7.

HALL, MAXWELL. **West Indian cyclones and the local wind.** Diagr. *Quart. Journ. Roy. Meteorol. Soc.*, No. 179, Vol. 42, 1916, pp. 183-189.

JACOBSEN, E. D. **Our new Caribbean Islands.** Map, ills. *Amer. Review of Reviews*, Vol. 55, 1917, No. 3, pp. 275-280.

— **New colony of the United States, The, in the Caribbean.** Map, ills. *Dun's Rev.: Internatl. Edit.*, Vol. 28, 1917, No. 2, pp. 36-41 and 46; No. 3, pp. 45-47. [An account of the economic resources of the Virgin Islands, with good photographs.]

PAYNE, C. H. **Danish West Indies.** 4 pp. *Suppl. to Commerce Repts., Ann. Series*, 1916, No. 37a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

SLOSSON, E. E. **Three Saints of the Caribbean: The Danish West Indies.** Ills. *The Independent*, No. 3535, Vol. 87, 1916, Sept. 4, pp. 333-335.

VAUGHAN, T. W. **Some littoral and sublittoral physiographic features of the Virgin and northern Leeward Islands and their bearing on the coral reef problem.** Map, diagrs. *Journ. Washington Acad. of Sci.*, Vol. 6, 1916, No. 3, pp. 53-66.

SOUTH AMERICA

GENERAL

BABSON, R. W. **The future of South America.** xi and 407 pp.; maps, ill., index. Little, Brown & Co., Boston, 1915. \$2.00. 7½ x 5.

This book is of more value for the impressions it records than for the information it furnishes. The impressions of a trained economic observer of a continent in which there is so much interest are likely to prove readable even if based on a rather short tour of the main traveled routes.

The book has two underlying ideas, not always fully expressed, which are worth noting. One is most clearly stated in connection with the West Indies, though various passages indicate that this idea seems to Mr. Babson more or less applicable to all Latin America at present. Though specially optimistic about Santo Domingo, about the West Indies as a whole he says (p. 37): "Any reader of this book who has energy and ability enough to make a success in the West Indies can with the same ability make a greater success in the United States." The other idea crops out in numerous places, namely, the need of new blood in Latin America, though to a less degree in Argentina. This thought is epitomized toward the end of the book when the author says (p. 357): "The great need of all Latin America is for a strong and industrious middle class. Place five millions of farmers in these countries and the future of them all is assured. But until there is a stronger middle class, the governments will continue weak, the banks will remain poor, the lands undeveloped, the minerals untouched, the water powers unharnessed and the future of South America will differ little from the past."

To these two opinions it is hard to take exception. Much of the information supplied, however, is evidently compiled from the usual handbooks. Occasionally some original data are given, for example, when the per capita failures of Argentina and the United States are compared (p. 243) to the disfavor of the former, being \$7.40 and \$2.55 respectively.

More enthusiasm than accuracy is employed when it is stated about the East Coast (p. 2) that "every inch of it is fertile" or about the Amazon valley (p. 315) that "it is impossible for the human mind to conceive the wealth and money-making opportunities in the great Amazon basin"—to which is added—"for those willing to pay the price" (italics my own). Mr. Babson's ideas of international exchange as shown on pp. 6-9 are a bit hazy, though he is certainly right in those same pages in saying that the United States is not getting all the news about South America. He undoubtedly overestimates Peru's future in cotton (pp. 157-158) because of the demonstrated limitation of area of cultivation of that staple. He probably underestimates Bolivia. Few would place, as he does, Venezuela ahead of Colombia in promise. With his general estimates of Uruguay, Argentina, and Chile, most authorities would probably agree. The familiar remarks about the vast area and resources of Brazil are present. It is interesting to contrast the physical content of the British Isles and Europe with their importance in the world.

Hurried preparation probably accounts for some minor errors in fact and form.

SELDEN O. MARTIN.

FARABEE, W. C. **Some South American petroglyphs.** Ills. Extract from *Holmes Anniversary Volume*, pp. 88-95. [Smithsonian Inst.], Washington, D. C., 1916.

Contains an interesting discussion of observations on petroglyphs along some of the rivers and savannas in southern British Guiana and northern Brazil. Incised designs of people, animals, etc., have been cut in rock in both exposed and hidden localities, on boulders, the faces of rock cliffs, and even in the midst of cataracts. Their meaning is not known, though there has been a good deal of theorizing about them with too little regard for the facts. The author makes an appeal for exact photographic copies. "It is difficult to draw a faithful copy, however much time is expended. For an example, see the numerous publications of the Dighton rock 'inscriptions.' Many copies were made by well-trained, educated men, yet no one could possibly recognize the earlier

copies from the later ones, or the original from any of them. One author thought them Phenician in origin, another Scythian, and a third Scandinavian, and each copied to suit his own preconceived idea. One's imagination can easily supply the missing line and make a monkey of a man. The camera has a good memory and no imagination." He concludes: "The study of petroglyphs is important because they are examples of early practices and the only evidence we have of an extinct culture. Whatever their significance may be, they are interesting to us because they are the first efforts by primitive man toward artistic presentation and mark a step in his evolution."

CAPEPEAU, I. M. **A voyage to South America and Buenos Aires, the city beautiful.** 134 pp.; ill. Sherman, French & Co., Boston, 1916. \$1.20. 8 x 5. [A rambling account in diary form of the ordinary South American tour.]

KING, C. P. **North American interests in South America.** Ills. *The South American*, Vol. 4, 1916, No. 12, pp. 327 and 342-345.

REID, W. A. **South America's part in supplying world's wool.** Ills. *The South American*, Vol. 4, 1916, No. 11, p. 299.

TOWER, W. S. **The Andes as a factor in South American geography.** *Journ. of Geogr.*, Vol. 15, 1916-17, No. 1, pp. 1-8.

WILSON, OTTO. **South America as an export field.** 216 pp., bibliogr. *Bur. of Foreign and Domestic Commerce Special Agents Series No. 81.* Dept. of Commerce, Washington, D. C., 1914. [A survey of the continent as a whole is followed by sections dealing with the individual countries from the standpoint of their resources and entry into trade, especially with the United States.]

BRAZIL

CARVALHO, C. M. D. DE. **Météorologie du Brésil.** With a preface by W. N. Shaw. xix and 528 pp.; maps, diagrs., ill., bibliogr. John Bale Sons & Danielsson, Ltd., London, 1917. 9½ x 6½.

Brazil is a country of tremendous possibilities. Although essentially a tropical land, and with heavy rainfall, high temperatures, and vast forests over its equatorial portion, most of it is an open country, of elevated rolling campos and scattered trees, and with an agricultural and grazing future of great promise. So large is Brazil, so varied are its products, so important is its future for us of the north, that any study of its climates—for it has many climates—is of interest to a large number of persons well outside of the ranks of meteorologists. This volume on the meteorology (perhaps better the *climatology*) of Brazil is clearly written, systematically arranged, remarkably complete, and interesting throughout. The author, professor in the Académie des Hautes-Etudes in Rio de Janeiro, recently residing in London where much of his work was done, has evidently written *con amore*. He has made a very careful study of the literature of his subject, and his numerous quotations, as well as his bibliography, are evidence of his thorough acquaintance with that literature. The effort has been to summarize, critically, what has been done, and thus at the same time to indicate what still remains to be done.

The subject-matter is logically arranged under three divisions. First, under general topics, the author takes up the larger climatic conditions of the southern hemisphere as a whole, the problems of colonization, acclimatization, and health, and gives an historical account of the meteorological organizations of Brazil. The second part is devoted to the distribution of the meteorological (climatic) elements. Here are discussed the influence of latitude, altitude, etc.; the régime of the winds; the distribution of rainfall and the rainfall types; and the climatic provinces. In the third part (somewhat over 300 pages) the climatography of Brazil is discussed. The climatic subdivisions here adopted are as follows: Super-humid: Amazonia; Semi-arid: northeastern Brazil; Semi-humid marine: east coast; Semi-humid elevated: the high plateaus; Semi-humid continental: central Brazil; Super-humid marine: south coast; Semi-humid in middle latitudes: Plain of Rio Grande; Semi-humid elevated: high southern plateaus. The book is so arranged, therefore, that the reader who wants only a general view may find what he seeks in the earlier portions, while anyone who needs detail may turn at once to the later pages. The charts and diagrams, while not very numerous or elaborately drawn, are sufficient. The publication of this volume gives us peculiar satisfaction. We cordially agree with Sir Napier Shaw, who contributes a foreword, in his estimate of the interest and importance of Brazilian climatology. And we feel sure that Professor de Carvalho's excellent piece of work will be welcomed by the large numbers of those who are seeking authentic scientific information about South America.

R. DEC. WARD.

AMARAL, BRAZ DO. *Memoria sobre as terras orientaes da antiga freguezia de S. João Baptista de Geremoabo*. Map. *Rev. Inst. Hist. e Geogr. Brasileiro*, Special Vol. Part I, pp. 951-988. Rio de Janeiro, 1915.

BONARDELLI, EUGENIO. *Vita intellettuale, sociale, religiosa degli Italiani nello Stato de S. Paolo*. Ills. *Italica Gens*, Vol. 6, 1915, No. 3-6, pp. 95-108. Turin.

— *Brazil: General descriptive data prepared in September, 1914* (reprinted May, 1915). 47 pp.; diagsr., ill. Pan American Union, Washington, D. C.

FERREIRA, J. R. *Boletim mensal de estatistica da Cidade de Belém*. Vol. 11, 1916, No. 6, pp. 1-49. Dir. Geral do Serviço Sanitario do Pará, Brazil.

GOTTSCHALK, A. L. M. *Coal and fuel oil in Brazil*. *Commerce Repts.*, 1916, No. 107, pp. 490-492. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

— *Harbor improvements in Brazil: Those at Rio Grande do Sul rapidly nearing completion; Agricultural and industrial activities*. Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 4, pp. 55-57. New York.

LYRA, A. T. DE. *A colonização da Capitania do Rio Grande do Norte até a ocupação hollandeza*. *Rev. Inst. Hist. e Geogr. Brasileiro*, Vol. 77, 1914, Part I, pp. 9-40. Rio de Janeiro.

RUCH, B. G. *Breves noções de physiographia brasilica (fragmentos)*. *Rev. Inst. Hist. e Geogr. Brasileiro*, Vol. 76, 1913, Part I, pp. 101-146. Rio de Janeiro, 1915.

SOPER, R. H. *The geology of Parahyba and Rio Grande do Norte, Brazil*. Maps, diagsr., ill. *Proc. Amer. Philos. Soc.*, Vol. 55, 1916, No. 1, pp. 1-20. Philadelphia.

— *Trindade, Ilha da: Posição geographica, extensão e topographia*. Map. *Rev. Maritima Brasileira*, Vol. 36, 1916, No. 5-6, pp. 349-365. Rio de Janeiro. [Historical and geographical sketch of the oceanic island of Trinidad lying 10° east of the Brazilian coast.]

— *Pernambuco, Mappa de estado de*. 1:500,000. Ministerio da Viação e Obras Publicas, Rio de Janeiro, 1915.

— *Amazon River. Para to Iquitos*. 1:1,400,000. In 3 sheets. *U. S. Hydrogr. Office Chart No. 1926*. Washington, D. C., July, 1916.

EUROPE

ITALY

ANFOSSI, GIOVANNI. *Sul regime dei corsi d'acqua nel bacino padano*. Maps, diagsr. *La Geogr.*, Vol. 4, 1916, No. 4-7, pp. 205-225. Novara. [On the regimen of the watercourses in the Po Basin.]

ANNONI, A. M. *Le nostre aspirazioni coloniali dopo la guerra*. *L'Esplorazione Commerce.*, Vol. 31, 1916, No. 8, pp. 281-289.

BORGIANI, GIUSEPPE. *I comuni della provincia di Ancona che hanno cambiato denominazione*. *La Geogr.*, Vol. 4, 1916, No. 4-7, pp. 225-230. Novara.

— *Condizioni del lavoro in Italia con speciale riguardo alla mano d'opera agricola*. *Boll. della Emigrazione*, Vol. 15, 1916, No. 4, pp. 5-41. R. Commissariato della Emigrazione, Rome.

CORRENTI, CESARE. *Le frontiere italiane: Il Trentino*. *La Geogr.*, Vol. 4, 1916, No. 4-7, pp. 186-193. Novara.

DE LUCCHI, GUIDO. *Trentino e Tirolo (Aprile, 1914)*. 82 pp. *Direz. Gen. degli Affari Comm. [Pubbl.] No. 16*, Minist. degli Affari Esteri, Rome, 1915.

FABIANI, RAMIRO, AND GIUSEPPE STEFANINI. *Sopra la natura e la distribuzione delle rocce terziarie della Venezia*. 23 pp.; map. *Ufficio Idrografico Pubbl. No. 66*. R. Magistrato alle Acque, Venice, 1916.

GORTANI, MICHELE. *L'opera forestale di Stato in Italia e le sue direttive*. *Giornale di Geologia Pratica*, Vol. 14, 1916, No. 1-2, pp. 43-52.

HYDE, W. W. *Mount Etna*. Ills. *Bull. Geogr. Soc. of Philadelphia*, Vol. 14, 1916, No. 2, pp. 37-59.

LOTTI, B. *Il Monte Fumaiolo e le sue sorgenti*. Map, diagr., ill. *Boll. del R. Comitato Geol. d'Italia*, Vol. 45, 1915, No. 3-4, pp. 115-135.

MASSARA, ANTONIO. *Paesaggi e costumi della campagna novarese*. Ills. *Riv. Mensile del Touring Club Italiano*, Vol. 22, 1916, No. 7, pp. 379-384.

PERRET, F. A. The lava eruption of Stromboli, summer-autumn, 1915. Ills. *Amer. Journ. of Sci.*, No. 252, Vol. 42, 1916, pp. 443-463.

RIGGS, A. S. *Inexhaustible Italy*. Ills. *Natl. Geogr. Mag.*, Vol. 30, 1916, No. 4, pp. 273-368. [Good photographs, some of which are geographical.]

SEGALA, GIACOMO. *I boschi del Trentino*. Ills. *Riv. Mensile del Touring Club Italiano*, Vol. 22, 1916, No. 9, pp. 497-504.

TENNEY, FRANK. Race mixture in the Roman Empire. *Amer. Hist. Rev.*, Vol. 21, 1916, No. 4, pp. 689-708. [Epigraphy applied to a determination of the degree and progress of Orientalization among the populace of Rome.]

ZON, RAPHAEL. *The industrial future of Italy*. Reprinted from *Yale Review*, July, 1916, pp. 702-713. Yale Publishing Assoc., New Haven.

WORLD AS A WHOLE AND LARGER PARTS

HERBERTSON, A. J. *A handbook of geography. Vol. II: Asia, Australasia, Africa, and America*. xvi and 681 pp.; maps, diagrs., index. Thomas Nelson & Sons, London, [1913]. 4s. 6d. 7½ x 5.

Volume 1 of this work has already been reviewed (*Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, p. 222). This, the last book which we can ever welcome from the pens of Professor and Mrs. Herbertson, may stand as a monument of the breadth of vision and clearness of presentation which geographers have come to expect from them. The regional method of treatment could have no severer test, nor prove its virtue more conclusively, than in the 179 pages given to Asia. The four great physical divisions of the continent are subdivided into 35 regions, and many of these into subordinate districts. The relief, structure, and drainage of each is described with sufficient fullness for the general reader. Eleven vegetation regions are correlated with ten climatic regions. This forms the basis of a brief economic survey, the whole serving as an introduction to a detailed discussion of 15 political divisions, Asiatic Russia having been discussed in Volume 1. Australasia and the Pacific Islands, Africa and America are treated in the same systematic manner.

In the general description of North America the reviewer has noted a score of questionable statements, most of which are of the same order of importance as the mention of "Mt. Mitchell, or Black Dome" as two names for a single peak. A chapter of 40 pages on the United States, contributed by Prof. Richard E. Dodge, shows how much safer the best of geographers may be when writing of their own country. Throughout the book, formal description is enlivened by picturesque quotations from original sources. There are more than two hundred of the simple, black-and-white maps in the use of which Professor Herbertson had no rival.

The general reader will find in this handbook a concise and trustworthy exposition of the geography of the globe, as it is understood by scientific geographers, and the student may find in it a model for the organization of the geographic material.

CHARLES R. DRYER.

CORNISH, VAUGHAN. *The strategic geography of the British Empire*. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 4, pp. 161-173. [A paper by the same author on the same topic, published elsewhere, was abstracted in the July, 1916, *Review* (Vol. 1, pp. 66-67).]

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PARKINSON, T. W. F. *A regional geography of America, Africa, and Australasia*. 318 pp.; maps, diagrs., index. Collins' Clear-Type Press, London and Glasgow, [1916]. 2s. 7 x 5.

SHERILL, C. H. *Modernizing the Monroe Doctrine*. With an introduction by N. M. Butler. xiv and 203 pp. Houghton Mifflin Company, Boston and New York, 1916. \$1.25. 8½ x 5½.

— *Strategic centers of world trade, The*. Map, ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 6, pp. 35-38.

WILSON, HARRY. *The integration of the [British] Empire. Maps. United Empire, Vol. 7, N. S., 1916, No. 10, pp. 654-672.*

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PHYSICAL GEOGRAPHY

GEOLOGY AND GEOMORPHOLOGY

VAN DYKE, J. C. *The mountain.* xvi and 234 pp.; ills. Charles Scribner's Sons, New York, 1916. \$1.25. 7½ x 5.

This is one of a series of little books by the same author, entitled "Studies in Impressions and Appearances." In this volume the author has attempted to paint a word picture which shall convey to the reader something of the inspiration which he himself experienced in the presence of mountain scenery in many lands. Since the true grandeur of Nature's masterpieces cannot be seen with the outer eye alone, Van Dyke very properly touches his brush to the palette of the geologist and physiographer to gain necessary color for a background against which the picture will appeal more strongly to the reader's understanding.

For the purpose of effective contrast, the first chapter is a telling picture of the Great Plains, the approach to the mountains of our western country. Visions of the Big Horns and more distant glimpses of the main Rockies gradually lead the reader's attention from the foreground of the picture to its main motive. A discussion of mountain-making processes is then introduced, in the course of which the author, like those historians who always begin with Adam, goes back to the nebular and planetesimal hypotheses in order to get a good start. There follow descriptions of outlying hills and foothills, the forest zone of the mountain proper, the barren uplands where lakes and torrents are more clearly in view, the glaciers and snow peaks of the highest levels with their associated spines and needles, and finally the over-arching sky of ever-changing colors.

The picture is skillfully drawn, and while it contains no such effective passages as Mark Twain's beautiful description of the Alps seen from the Rigi-Kulm in "A Tramp Abroad," it is harmonious throughout and effectively imparts to the reader the author's enthusiastic love of the mountains. For the ordinary mountain climber the author entertains a fine scorn, and aptly remarks that this species usually possesses better legs than eyes. One also detects a certain quiet enjoyment on the author's part when he describes changes of view incident to scientific progress as "science reversing itself"; yet he draws liberally upon the sciences of geology and physiography throughout the book. Indeed, it is just here that his artist's brush becomes most unsteady. One may pardon his using a technical term like peneplane without explanation and apparently without understanding; but to attribute the spines and needles of Alpine ranges to vertically tilted strata, and to omit mention of glacial sculpture followed by normal weathering of jointed rock, the principal causes of the forms in question, is a defect of more serious proportions; and of such defects there exist not a few. Despite their existence the volume makes delightful and profitable reading for every lover of Nature, be he trained scientist or untrained layman.

DOUGLAS W. JOHNSON.

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A textbook dealing with the flowering plants with reference to their morphology, physiology, ecology, and classification. The book is divided into five sections, as follows: the vegetative organs (pp. 11-155); the reproductive organs (pp. 156-228); systematic botany (pp. 229-269); common trees and shrubs (pp. 270-314); ecology (pp. 315-399).

Much more stress has been laid on the ecological relations of plants and of vegetation than is customary in elementary botanical texts, and in this respect the book deserves special commendation. The nature of the section on ecology is suggested by the chapter headings: plant habitats and communities, the soil, plants of hedgerows and walls, woodland plants, plant life in humus, grasslands (pastures and moors), water and marsh plants, weeds, the vegetation of the sea-coast, moorland and alpine plants.

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THE GEOGRAPHICAL REVIEW

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No. 6

FLANDERS

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Flanders, or the Flemish Plain, is the low, flat, and damp country which abuts on the higher and drier lands of the Heights of Artois on the southwest and the Brabant Plateau on the east and whose limits may be roughly described as the North Sea, the lower Schelde and its estuary, the Dender River, a series of dry chalk ridges south of Lille, and the Heights of Artois. This region, since the early Middle Ages, has been one of the most active centers of western Europe; and the furious battles which have been fought there since October, 1914, have given it a new and terrible renown.

The people who inhabit this region, as many peoples elsewhere, have been deeply influenced by the character of the land, but in few regions has man been able to overcome so successfully as here the obstacles placed in his way by an inhospitable nature and to create for himself so satisfactory an abode. To understand the measure of this struggle and its success, it is first necessary to outline somewhat in detail the physical development of the area.

DEVELOPMENT OF THE PHYSICAL FEATURES

The Anglo-Flemish Basin. That Flanders is a lowland is primarily due to the fact that it forms part of an extensive zone of submergence. It is, indeed, only a part of the Anglo-Flemish Basin, the counterpart of the Paris Basin on the other side of the Artois anticline. On it thick beds of sediments were deposited by the sea. These sediments are all clays, gravels, and sands, the characteristic rocks of Flanders, and the beds are locally several hundred meters deep. The last deposit of the region is a thin bed of ferruginous gravels and sandstones deposited upon a peneplane. Thus Flanders finally had the appearance of an uninterrupted and perfectly even coastal plain, slightly tilted upwards to the southwest about an axis

in the neighborhood of Antwerp. It was on the peneplaned surface, after these successive stages of submergence and emergence, that the present topography was carved.

Relief and Drainage. The sea having withdrawn northeastward toward what is now Holland, the watercourses which were to model the relief of the country took up the same direction. They formed consequent trunk streams, flowing from the uplands of Artois in a northeasterly direction. The upper Aa, the Lys, the upper Deule, the middle Schelde, and the Dender River represent the chief remnants of these streams. The largest of these consequent streams occupied the site of the Strait of Dover and flowed parallel to the present coast of Flanders. Broad and deep valleys



FIG. 1.—Sketch-map of Flanders and its limits as a natural region. Scale, 1:2,000,000, or about 32 miles to the inch.

were developed. The beds, their edges outcropping at a low angle, parallel to the axis of Artois, were not equally soft. The clays were more resistant than the gravels and sands. Along each of these clay outcrops a small cuesta developed. Four successive lines may be traced, each one representing the outcrop of a clay bed dipping northeastward. But these cuestas were composed of rocks of so little resistance that they have been reduced to a series of low hills, more and more dissected and disconnected as one goes westward. The most noteworthy of these series of hills consists of Mont Cassel (173 meters, or 568 feet), the Mont des Cats, the hillocks near Ypres and Tourcoing, and the Renaix hills. It is known as the "monts de Flandre" and corresponds to the outcrop of the Ypres clay. Between these ranges of hills the sands and gravels have been washed away to a considerable degree, producing large depressions. The most important is the depression which extends in front of the Ypres beds, along the foot of the uplands of Artois, from St. Omer to Lille, namely the plain of the Lys River. Thus the former gently sloping peneplane is today completely

dissected, and the *cuestas* themselves are hardly recognizable. All Flanders is now a great plain extending outward from the foot of the Heights of Artois, interrupted here and there by isolated hills. The hydrographic system which has been the agent of so great a change is therefore in an advanced stage of development. New connections have been established between the different trunks, and the upper waters of the old consequent streams have been captured by the headward growth of the branch valleys (Fig. 2). Thus, the upper Deule was beheaded and turned to the Lys; the upper Dender was tapped by the middle Schelde; and the Aa River, formerly a tributary of the Lys, has been turned to the North Sea. All these captures have added to the streams flowing west of the beheaded rivers.

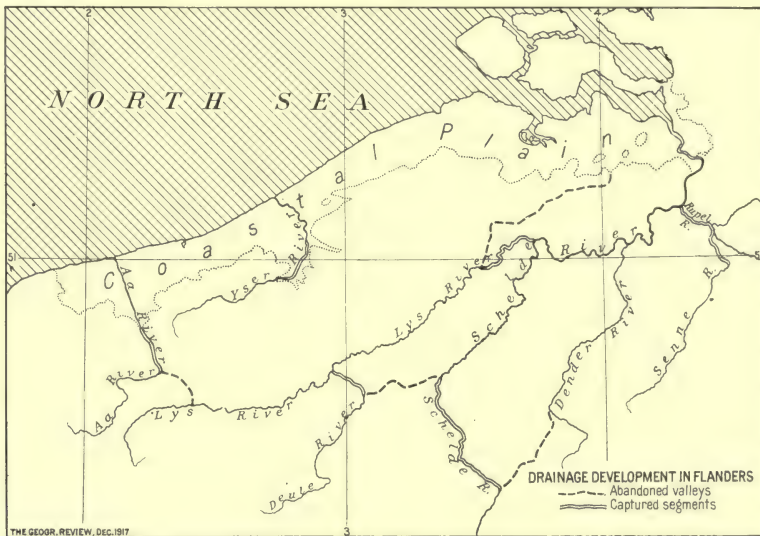


FIG. 2—Outline map showing the physiographic development of the principal Flemish rivers. Scale, 1:2,000,000, or about 32 miles to the inch.

This is due to the fact that a recent advance of the sea during Quaternary times—the one which created the Strait of Dover—determined a new base level west of the Flemish plain.

Formation of the Flemish Sea. The “Flemish Sea,” as one may call the southern part of the North Sea between the shores of England and of Flanders, has indeed a recent origin. At the end of the Pliocene and during the early Quaternary, Britain was connected with the Continent. A period of subsidence during the middle Quaternary caused the sea to advance into all the Flemish valleys, especially into the bed of the large stream which paralleled the present shore. Thus a junction was effected with the waters which, in the Paris Basin, had entered the lower valley of the Seine, at that time extending as far as what is now the Channel. The Strait of Dover was thus definitely opened at this period. The action of the tides from the Channel passing through the new strait created the

system of northeast-southwest shoals which at present characterize the submarine relief of the Flemish Sea.

Such was the last of the great changes having a bearing on the final constitution of the soil of Flanders. At the end of the middle Quaternary the sea showed a tendency to recede slightly; it progressively abandoned the Flemish valleys, leaving there thick deposits of clayey sands (the so-called Flemish sands). But it still occupied the broad *talweg* on the site of which the Strait of Dover had been opened. On the Continental side the sea created an uncertain shore line and then advanced upon it anew. Thus were determined two Flanders: the first, along the shore, a coastal plain, continually subject to an advance or recession of the sea and thus intimately dependent on maritime phenomena; the second, inner Flanders, less flat, more forested, and more varied in aspect. It is there that we may best find displayed the essential traits of Flemish life: intensive agriculture combined with highly developed industry and an extraordinarily dense population.

THE COASTAL PLAIN

From Calais to Antwerp, along the coast of the North Sea, stretches a low plain 10 to 15 kilometers (6 to 9 miles) wide. This plain extends also through Zealand, Holland, Friesland, East Friesland, and the marshes of Schleswig to Jutland. This long fringe of low-lying land forms an area which is still in dispute between land and sea and is the scene of the last struggles between the two elements in the Anglo-Flemish Basin.

The Last Advance of the Sea. The last phases of this struggle took place a relatively short time ago. The Quaternary sea had withdrawn little by little from the present site of the plain; a line of sand dunes arose along the shore; behind them lay a series of fresh-water lagoons, which filled slowly with peat. It was on the peat bogs thus formed that Neolithic man lived. Traces of his existence have been found on their surface. Later came the Gauls and, finally, the Romans. It was across this boggy soil that the soldiers of Caesar and Labienus marched, pursuing the Menapii into the forests and swamps. Numerous remains of pottery and specimens of medals and coins show that the plain was occupied by the Gallo-Romans up to the end of the fourth century of our era.

Then a new change occurred. Since these Roman and prehistoric remains are today found buried beneath two to three meters of sand and gray clay, mixed with sea shells, it is certain that the plain was inundated at a later date than the end of the fourth century. History makes no mention of this inundation; however, this absence of written accounts is due to the fact that the advance of the sea took place at the same time as the invasion of Flanders by the Franks, that is to say coincidentally with the temporary suppression of all intellectual activity in that region. On the other hand, the inundation was neither sudden nor severe. In no place

was the peat gullied to any great depth. The on-coming of the water must have been slow and regular. The height of the flood was never extreme, since a certain number of shoals built up by the Quaternary sea were not submerged by the inundation of the fifth century. The waves covered the plain behind the dunes only at high tide; at low tide the water remained only in the winding channels, and the plain was a vast stretch of gray mud cut by narrow inlets. The *wadden* (mud flats) of Friesland present exactly the same appearance today behind the row of Frisian islands. The process is the same, but in Flanders its evolution is farther advanced.

The Emergence of the Plain. Indeed the sea probably soon receded from the coastal plain. Precisely because the inundation had been slight, the alluvial deposits carried by the tides of the Channel must have soon formed a bed deep enough to render the sheet of sea water extremely shallow upon the invaded area. After some centuries the deposits had increased to such a thickness that at high tide the waters could inundate the land only at rare intervals. From this time on vegetation sprang up on the beaches, transforming them into grassy plains, or *schorres*. Soon, man took possession of these new lands, brought his flocks of sheep, and built villages. The first of these villages, whose existence is established by the registers, or cartularies, of the great abbeys, were placed near the present shore upon the lines of dunes that the invasion of the sea had left untouched. In the eighth century, even the inundated zone began to be inhabited. As a precaution the new inhabitants erected dikes to protect the country against new attacks of the sea.

These dikes were particularly necessary along the estuaries which the sea still occupied and into which the rivers emptied. We know several of these estuaries, the gulfs of Calais, Gravelines, Dunkirk, Nieuport, and the Zwin gulf (the estuary of Bruges). Even these disappeared rapidly because the waters of the streams were not able to sweep away the deposits that the sea unceasingly accumulated in the creeks. The western gulfs shrank little by little to the sizes of the old basins of the ports of Calais, Gravelines, and Dunkirk. The gulf of Nieuport resisted longer; but at the end of the thirteenth century the tide definitively abandoned the vast plain which was to become the battlefield of the Yser. Finally, the Zwin had the same fate, shrinking continuously in spite of the desperate efforts of the burghers of Bruges to preserve this magnificent port. In the thirteenth century the tide did not reach farther up than Damme; in the fifteenth, not farther than Sluis; and in the sixteenth, the port of Bruges also had to be abandoned. Thus the coastal plain soon became dry. Man had no part in this conquest. It was accomplished by alluvial action alone, and it is not necessary to imagine a movement of the earth's crust to explain it. Man, however, had much to do in reclaiming this soil for cultivation.

The Reclamation of the Plain. These new lands abandoned by the sea had to be protected, in fact, against a many-sided enemy—water. It was



FIG. 3—Typical landscape in the Pevèle district of inner Flanders, between Lille and Douai: village of Bouvignies, south of Orchies. (Figs. 3 to 11 are from photographs by the author, Figs. 5, 6, 7, 10, and 11 being from his "La Flandre," Paris, 1906.)

necessary to protect the land against it in its various forms, whether salt or brackish or fresh.

The salt water of the sea, although apparently the most threatening, is not difficult to conquer. Repeated attacks of heavy tides are likely to happen at any time, because the surface of the plain, carefully drained by man, has settled, and is lower today than it was at the end of the Middle Ages. This, for instance, made it possible for the Belgians to stop the German advance on the Yser by permitting the sea water to overflow the ancient site of the gulf of Nieuport. But defence against this element, terrifying in appearance, is easy. The line of dunes forms, for almost the whole length of the coast, a most effective protection. In the places where these are broken in order to give exit to the fresh waters of the streams, dikes have been built of earth, not very rigid, but resistant, reinforced sometimes with stones and brushwood. It is unusual for storms to break this seemingly weak rampart and invade the country.

Far more difficult and complicated is the struggle against the brackish water which seeps under the dunes and tends to mount to the surface, destroying the vegetation, and against fresh water, as represented by rain and river water, which requires direct drainage to the sea. This problem is all the more difficult, as the plain is absolutely level and drainage cannot take place except at low tide, twice a day. For this reason it has been necessary to dig canals and ditches, in order that the water may be carried away as rapidly as possible towards the coast, and to erect a system of locks, by means of which the drainage can take place at low tide, while at high tide the closing of the headgates prevents the entrance of the sea. Finally it has been found necessary to keep enough fresh water in the ditches and canals to irrigate the land and prevent the rising of the brackish water.

This delicate and complicated task could only be effected by co-operation. It was impossible for an individual to build the canals, to continue them across a neighbor's territory, to install the sea gates, and to assure their proper management. Organization was necessary. An association was formed, the "Wateringue," consisting of a group of landowners who undertake the construction of the requisite works, supervise their operation, and divide the expense among themselves in the form of a special tax. This association has "rectified" the courses of streams, has built an immense network of drainage canals, and has installed a great number of locks besides those which are necessary for navigation. Today, fresh-water floods have become infrequent, the marshes have been drained, and agriculture is everywhere possible. The value of the reclaimed land proves the effort to have been worth while.

The Life of the Plain. The soil of the coastal plain is by far the richest in all Flanders. The gray clay deposited by the inundation of the fifth century forms in its natural state a soil of extraordinary fertility, and it



FIG. 4.



FIG. 5.

FIG. 4—Scene in the coastal plain: the village of Lampernisse west of Dixmude.

FIG. 5—A clearing, the site of a former peat bog, in the marshes of Ardres: coastal plain at the base of the Heights of Artois.



FIG. 6.



FIG. 7.

FIG. 6—Dune landscape on the coast of western Flanders. In the distance, Grand-Fort-Philippe, a town below Gravelines at the mouth of the Aa.

FIG. 7—A sluice-gate on the coast at Groede at the mouth of the Scheldt estuary. Drainage canals are necessary to carry off the superfluous water of the coastal plain, because its absolutely level character does not allow any natural run-off. Drainage is effected twice a day, at low tide, by means of an elaborate system of canals and locks, constructed and maintained by a co-operative association known as the "Wateringue."

is easy to restore by the use of fertilizers whatever richness cultivation has destroyed. It has therefore been the custom to grow crops that require a rich soil, such as wheat, flax, and, at present, sugar beets and chicory. The dampness of the soil favoring the growth of grass, natural meadows are still extensive and luxuriant. Cattle are brought here to be fattened for consumption in the large cities, and butter and cheese are produced. These agricultural resources support a well-to-do population, but somewhat sparse, as compared with the rest of Flanders. Settled at a relatively late period, the country was never crowded; and, as large funds were needed for the reclamation work, farming is done on a large scale, with the help of day laborers coming from inner Flanders, who go back after the crops have been gathered. There is no other industry. The coastal plain is therefore entirely a rural district, where the inhabitants live either on large farms, almost settlements in themselves, or in small villages. These villages generally consist of a row of cottages built on a dike running along a canal, in order to secure protection against inundation and have the advantage of a highway. Towns are extremely few, and, except for such instances as Furnes and Bourbourg, they are found only in the southern part of the plain, where it borders inner Flanders. Consequently they are important markets, places of exchange between dissimilar regions. The most noteworthy of these towns on the line of contact is Bruges, which was for a time the emporium of northwestern Europe but now has declined to the status of a mere local capital and market town, sleepy and impoverished, although it still retains the magnificent architectural monuments of the period of its prosperity.

The Coast. Contrasting with the placidity and the somnolence of the plain, the coast itself is active and densely populated. All along the straight line of dunes of which it is made up lives a numerous and active population. The land being less valuable, because less fertile, a large number of small farmers have settled here who work small holdings of sandy soil, from which they get good results, however, by unremitting labor. Alongside of these men who devote themselves exclusively to farming, live the fishermen; they keep their boats in the nearest harbor, but each one of them also has a small piece of land which he cultivates. Row upon row of clean and bright little houses can be seen along the dunes or in the depressions between them. On the shore, bathing resorts have been established which permit the people to enjoy the perfect beaches of fine sand, hundreds of meters wide at low tide. From Dunkirk to Ostend the coast is skirted by villas and hotels and lined by an elaborate dike promenade. No less than seven ports exist in this section.

These Flemish ports are not all of the same importance, and they differ also in their origin. Some are natural harbors left by the transformation of ancient estuaries; others have been completely constructed by man. But all of them, to prevent silting and to meet the local conditions of

wind and tide, had to be improved artificially. Man has had to work continuously to preserve them as ports. Dredging is a never-ending necessity to remove the accumulation of mud and silt deposited at high tide. In function and importance these ports also differ greatly. Blankenberghe, Nieuport, Gravelines are only fishing ports. Zeebrugge, which is entirely artificial, was created as a port of call and is sheltered by an immense curving mole protruding into the sea. It is used as a submarine base by the Germans in the present war. Calais and Ostend are ports for passengers and express traffic. In each port the part that has been best developed is the outer harbor, making it possible for vessels to dock at any time of day. Dunkirk, above all others, is today the great entrepôt of the Flemish coast, since it is the gateway to the rich industrial and agricultural region of Northern France. The growth of this port has been so rapid during the last fifty years that, although its basins have been frequently enlarged, they have not kept pace with the traffic, and congestion is its ordinary condition.

We thus see that the coastal plain is not only a quiet and prosperous rural district; it is also the façade of the enormous agricultural, industrial, and commercial organism of inner Flanders.

INNER FLANDERS

In spite of the nearness of the two regions and of their common characteristics of low elevation and humidity, inner Flanders differs in many ways from the coastal plain. The coastal plain is a fertile country, given up to farming, and relatively sparsely populated. Inner Flanders, on the contrary, is a poor land, made productive only by hard work and intensive cultivation. But what is more, it is a region where the enormous density of population makes possible and at the same time calls for highly developed commerce and especially industry.

Soil and Agriculture. Contrary to the legend which makes of Flanders pre-eminently a rich and fertile land, a legend owing its currency to the qualities of the coastal plain, the inner part of the country has only a meager soil, hard to cultivate, demanding obstinate toil. To the east, the soil is made of Quaternary sands, mobile and dry in some places like the sands of the dunes, so much so that it is necessary to stabilize them by planting grasses and the like. This sandy soil, poor in the elements needed for plant growth and exposed by radiation to disastrous frosts, can be made productive only by means of fertilizers. To the west, clays are found instead of sands, a condition hardly better, for tilling is often impossible because of their hardness and stickiness; and furthermore their chemical composition is none too good. The impermeability of the subsoil also necessitates artificial drainage, an arduous and costly process.

Such a land can be made to yield plentifully only by toil. Flemish agriculture is, as it were, a constant miracle. The necessity, however, of



FIG. 8.



FIG. 9.

FIG. 8—Scene in the coastal plain. A group of field workers in the middle background.

FIG. 9—Farm house in the prosperous country around Bailleul, southwest of Ypres, inner Flanders.



FIG. 10.



FIG. 11.

FIG. 10—Typical dike village of the coastal plain: Westdorpe, north-northeast of Ghent. Location along a dike affords protection against inundation and gives access to a highway.

FIG. 11—A typical hillock in the Flemish plain: Mont-Aigu near Loere. Relatively insignificant elevations of this sort form the strategic points in the present fighting in Flanders, as they dominate the surrounding plain.

feeding an enormous population, attracted to this region by its facilities for commerce, and the stubborn persistence of the Flemish peasant, have turned these ungrateful lands into a rich agricultural region. A multitude of small farms have come into existence where man, armed with his heavy spade, engages in a hand-to-hand struggle with the land; while, at the same time, more scientific work has been done by landowners who are always on the lookout for improved methods of cultivation. In the use of fertilizers, in the rotation of crops, in the introduction of new grains, Flanders, rather than England, may be considered as the founder of modern agriculture.

The products obtained are various. On the sandy soil of the east are produced rye and potatoes. As one proceeds towards the southwest, the aspect and the composition of the vegetation change. While in the infertile east tree hedges and meadows predominate, in the more fertile west the soil is more completely devoted to cultivation and the landscape is more open. Wheat occupies the larger tracts, but crops of such economic importance as tobacco, flax, chicory, and sugar beets are also grown. The essential feature, however, of Flemish farming is cattle breeding, which is of growing importance. The greater part of the crops is used for the feeding of live stock. There are wide stretches of pasture land in this humid district, and these are being extended. The size of the herds, especially of cattle, has grown greatly, particularly in eastern Flanders, where the crops, too meager for man, are better adapted to feeding cattle. The density is almost everywhere more than one head per hectare ($2\frac{1}{2}$ acres), a proportion rarely equaled in any other country. Cattle raising, in fact, is the chief agricultural industry of inner Flanders, not only for the profit it brings, but also for the fertilizer it furnishes.

Manufacturing. Nevertheless, all the Fleming's labor on his soil and all his ability to draw from it crops large beyond expectation would not suffice to support him. This region has been too densely populated since the early Middle Ages for agriculture to suffice as the sole means of subsistence. Something else was necessary. Therefore, the people have always turned to manufacturing to supplement their resources. Manufacturing has always found favorable conditions in Flanders. The country furnished the raw materials—textile plants and wool of the sheep raised among the dunes. Laborers were at hand in abundance; indeed industries were necessary to occupy them. Finally the excellent means of communication made it easy to import raw materials from abroad and to export the manufactured products. The country was not only situated on the crossroads, so to speak, of the great sea routes of western Europe, but also communicated easily by land with France, Germany, and the Netherlands. In the interior of Flanders, while the character of the soil made the roads muddy, rutted, and difficult, an admirable system of navigable waterways permitted traffic to circulate freely. For these reasons, since the early Middle Ages, the

linen and woolen industries have flourished in the towns as well as in the rural districts throughout inner Flanders.

The industrial revolution of the nineteenth century, in modifying the character of this industry, has strengthened it. The establishment of factories run by steam has produced a concentration of industries in the cities at the expense of the house industries carried on in the country. Three principal centers have been thus formed, at the meeting points of various highways of traffic, at Ghent, Courtrai, and Lille. In these three centers the manufacture of textiles from flax, wool, jute, and cotton is the predominating industry almost to the exclusion of all others. The Lille group is by far the most important of them because it enjoys particular economic advantages. Situated near the Belgian frontier, it profits by the differences created by the custom duties between France and Belgium. In Belgium, a country of free trade, where the cost of living is less, Lille recruits its army of laborers at a low wage. These laborers, taking advantage of the proximity of the frontier, work in France without losing the privilege of living in Belgian territory; and so the factories of Lille, enjoying a protective tariff, have at the same time plenty of Belgian laborers who accept a lower wage than the French could do. This artificial condition, favorable to both employers and employees, is the principal cause of the enormous development of the group of cities comprising Lille, Roubaix, Tourcoing, and Armentières, which, with their 150,000 workingmen, form one of the most important industrial centers of western Europe.

Along with this industrial growth of the cities, however, manufacturing again tends to invade the country districts. As in the Middle Ages the country people are eager to add an industrial income to what their agricultural products bring them, and the employers, on their part, tend to look to the country for laborers who are more docile and who are satisfied with less. The movement of expansion is therefore clearly defined. The Ghent center is spreading little by little over the whole of eastern Flanders, where factories are being built in the villages and in the towns; already there are more cotton looms outside of the city than in Ghent itself. The Courtrai center is becoming elongated and is expanding across central Flanders from the vicinity of Ypres and Roulers to Renaix. The industries of Lille are advancing to the west, as far as Hazebrouck and Béthune; to the south, its manufacture of ready-made garments extends its influence beyond the border of Flanders towards the coalfields. Inner Flanders thus tends to become one great factory, while at the same time remaining one of the richest agricultural lands of Europe.

These two conditions explain the presence, in so small a territory, of so large a population.

The Population. Flanders is densely and very diversely populated. There are a great number of cities, of which several have more than 100,000 inhabitants, and yet few other regions in the world have so large a rural population.

The cities of inner Flanders are the natural product of conditions favorable to commerce and industry. They have sprung up and developed at the confluence of rivers, at the crossings of land and river routes, at the zone of contact between different regions. But in the nineteenth century all the cities which have not felt the industrial renaissance have languished or decreased in importance, as for example Ypres and Bruges. On the other hand, those which have become centers of industry have experienced wonderful growth. Alost, Courtrai, and Roulers have tripled in size in the last century. Ghent, which had 55,000 inhabitants in 1801, numbered more than 200,000 in 1910. In the Lille region the progress has been more remarkable still. Armentières had 7,500 inhabitants in 1804 and 52,000, with its suburbs, in 1901. Lille from 75,000 grew to 290,000. The two towns of Roubaix and Tourcoing have increased tenfold (from 20,000 to 203,000). With their suburbs, these two urban centers, Lille and Roubaix, almost form one city of 600,000 inhabitants.

However, in spite of this urban expansion, the rural districts preserve a large population, which sometimes exceeds 400 inhabitants to the square kilometer (1036 to the square mile). What is still more remarkable, this rural population remains widely scattered. The individualism of the Fleming has been fostered by the nature of the soil, for the impermeability of the subsoil makes it possible for him to reach water everywhere not far below the surface and thus to build his house wherever he wishes. The house standing alone by itself is thus the ruling type throughout inner Flanders. There is a difference, however, between the east and the west in the distribution of these scattered dwellings. In the west, where the soil is more clayey and wet and where communication was difficult before the building of roads, the houses were built as if by chance anywhere about the countryside in the middle of the farmer's land; and they are often still scattered in this manner, although the building of roads has exerted an attraction toward the crossroads. In the east, where the sandy soil was more viable, the houses are always ranged along the roads, but with some space between them, so that every road looks like a long suburban thoroughfare with houses separated by fields. Thus is satisfied the instinct for independence so ingrained in the heart of every true Fleming.

The figures for the density of population are striking. Before the war the total population of the natural region of Flanders as here defined was estimated at 3,250,000 for an area of 10,000 square kilometers (3,860 square miles), or 325 per square kilometer (842 per square mile)—a remarkable figure, comparable only with those of the most densely populated regions of the globe. In some parts the average is even much higher. Eastern Flanders has 250 inhabitants per square kilometer (647 per square mile); the Flemish part of the French Département du Nord, more than 500 (1,295 to the square mile); the "arondissement" of Lille, more than 800 (2,072 per square mile). In the Alost district, eleven purely rural townships have

more than 400 inhabitants per square kilometer (1,036 per square mile). The presence of such dense populations is comprehensible in the highly industrial districts; but in the purely agricultural sections, with their poor or only moderately fertile soils, it is a veritable marvel, in fact a sociological problem that can be solved only by emigration. Flanders is over-populated and has always been so in proportion to its resources. Part of the population must submit to the necessity of going away to find what its own country cannot offer. In the twelfth, thirteenth, and fourteenth centuries colonies of Flemish people settled in all parts of Europe, even as far as Transylvania; others left in the sixteenth and seventeenth centuries and especially in the nineteenth century.

Today, emigration is still taking place but it has assumed more varied forms. Numbers of workingmen, availing themselves of the facilities offered by railways, travel every day or every week to their work in the large industrial centers, either in France or Belgium. This shifting population amounts to perhaps 50,000 or 60,000. Others leave for a whole season, going south to the brick-kilns and especially to the rich agricultural region of the Paris Basin, and farther south, to Auvergne. More than 50,000 take part every year in this pacific invasion. A large number settle permanently outside of Flanders, in Artois, Picardy, or in the Walloon country; others go to Canada or to the region of the Great Lakes. Overpopulous, Flanders is gradually emptying itself towards the West.

Thus we see that Flanders is not a country of easy and careless life. Man has had to struggle with all his might against nature, and the struggle is one which never ends. The coastal plain has been wrested from the water and is preserved only by the utmost care and attention. The inner lands, meagerly endowed, only by long and patient efforts have been transformed into a prosperous agricultural and industrial region. Few regions show to such an extent the marks of human toil. This continuity of effort, indeed, gives ground for the hope that, at the close of the war which has so cruelly devastated it, Flanders will not be long in recovering her prosperity, thanks to the indomitable energy of her children.

A JOURNEY ON THE RIO ZAMORA, ECUADOR

By J. L. HERMESSEN

The Andes of Ecuador part into two main parallel ranges, known as the Cordillera Occidental and Cordillera Oriental, united at intervals by transverse ridges of inferior height, designated by the Spanish topographical term of *nudos*, literally "knots."¹ The southernmost of these is the Nudo de Cajanuma, which forms the divide between Pacific and Amazon-Atlantic drainage; some twenty-five miles to the north is the Nudo de Acayana y Guagra-uma; and enclosed between the two and the lateral mountain chains is the Basin of Loja (Hoya de Loja). The opposite inner faces of the two Cordilleras are here physiographically similar, but the outer, or Pacific and Amazon versants, respectively, are in distinct contrast. The former, through the withering action of the hot, dry air currents borne up the Catamayo valley from the desert littoral of Peru, is bare of vegetation, while the latter, under the benign influence of perennial rains, is clothed with dense tropical forest.

In the intermontane depression between the two ranges, at an elevation of 2,150 meters (7,053 feet) above sea level,² stands the town of Loja. Due west of it the isolated and sharply outlined peak of Villonaco (3,220 meters, or 10,560 feet) rises from the relatively low profile of the Cordillera Occidental, forming a dominant feature of the local topography and a widely visible landmark. It is interesting to note that certain neighboring eminences, Fierro-ureu (3,788 meters, or 12,430 feet) and Colambo (3,094 meters, or 10,150 feet), were occupied as trigonometrical stations in the great triangulation carried from Tulcán, on the Colombian frontier, all through Ecuador down to Payta, in Peru, by the French geodetic commission in 1899-1906, in their revision and extension of the work of the academicians Bouguer, La Condamine, and Godin in the eighteenth century for the measurement of an equatorial arc of a meridian.³

The lower slopes of the Cordillera Oriental about the Hoya de Loja are

¹ This peculiar articulation of the Ecuadorian Andes, often obscured in ordinary maps by other detail, is very clearly depicted in a diagram in Dr. Teodoro Wolf's "Geografía del Ecuador." Leipzig, 1892, p. 582. In "Quito to Bogotá," New York, 1917, a diary of travel containing valuable physiographic notes on Ecuador and Colombia, A. C. Veatch describes the Eastern and Western Cordilleras of Ecuador as the parallel rims of a single broad mountain mass. To the separate basins defined by the cross-ranges he appropriately applies the term "mountain park," commonly used to designate certain basins of the southern Rockies.

² Wolf's figure, 2,220 meters (7,282 feet), is undoubtedly too high. The engineers of the Inter-Continental Railway Commission, who ran a survey through Loja in 1891-1892, placed it at 7,138 feet (2,176 meters); while Dr. Wilhelm Sievers, on a route survey made by him in 1909 (sheet 3 of his map in 1:500,000, *Petermanns Mitt.*, Vol. 61, 1915, Pl. 25), gives 2,185 meters (7,167 feet). The value which I have adopted is the mean of a series of observations with my own aneroid over a period of some weeks.

³ Mission du Service Géographique de l'Armée pour la mesure d'un arc de méridien équatorial en Amérique du Sud sous le contrôle scientifique de l'Académie des Sciences, 1899-1906, in 10 volumes; reference in Vol. 3, Part I, Pl. 7, Paris, 1910.

the natural habitat of a number of species of the Peruvian bark tree—*Cinchona (officinalis) loxensis*, *C. succirubra*, *C. calisaya*, *C. condaminea* (named by Humboldt and Bonpland in honor of La Condamine), etc.—from which the valuable drug quinine is derived. The collection of the bark from wild trees was formerly a considerable industry of the district, but it fell off altogether when the cinchona of the East Indies, introduced from the Andes in the early sixties,⁴ came to maturity.

It is in this district that the Rio Zamora has its source. Rising in the western foothills of the Cordillera Oriental the Rio Zamora flows through Loja, where it is joined by the Rio Malacatos.⁵ Ten miles farther north, in confluence with the Rio de las Juntas, it breaks through the Andes and enters the province of Oriente, the Amazon region of Ecuador, comprising a northwestern part of the basin of the great river. Vast in extent and largely unknown, unexplored and unmapped, this territory has always been a bone of contention among the republics of Ecuador, Colombia, and Peru. But although the particular portion of it which I visited, on a reconnaissance of the Rio Zamora, was supposedly under the sovereignty of Ecuador, no evidence of administrative authority was to be found there, nor did the savages of the Jíbaro tribe who live there acknowledge allegiance to the government at Quito.

I had thought of following the Zamora all the way into Oriente from Loja, but this was quite impracticable on account of the density of the vegetation and the existence of many deep *quebradas* (gorges) impassable for animals. I was thus obliged to take the trail over the Andes, reaching the river again at a point called Sabanilla. Here the Zamora runs southward, ultimately paralleling the course of all the principal affluents of the Upper Amazon, or Marañon,⁶ as it is more usually called above Iquitos, to its union with the latter at the Pongo de Manseriche.

The ascent of the Cordillera, for a distance of five or six miles out of Loja, was fairly gradual, but then became excessively steep, the winding rocky path being worn in places into irregular steps, affording poor foothold and rendering progress very slow and wearisome.

Throughout the Andes and other great mountain ranges of South

⁴ The Indian Government entrusted this work to Sir Clements Markham ("Travels in Peru and India," London, 1862). Its success as regards the South American side of the undertaking is credited in large part to the labors of the eminent botanist Spruce: for his work in Ecuador see "Notes of a Botanist on the Amazon and Andes," by Richard Spruce, edited and condensed by Alfred Russel Wallace, 2 vols., London, 1908. On the subject of the cinchona of Loja is an interesting memoir written in 1805 by Fr. José de Caldas: "Memoria sobre el estado de las Quinas en general y en particular sobre las de Loxa." It appears in the volume "Expedición botánica de José Celestino Mutis al Nuevo Reino de Granada [1783-1808] y Memorias inéditas de Fr. José de Caldas [1801-1805]," by Diego Mendoza, Madrid, 1909.

⁵ Not to be confused with another river of the same name, rising at Cajanuma on the Pacific side of the Cordillera Occidental and discharging into the Rio Catamayo, which latter, under the name of the Rio de la Chira, reaches the sea near Payta, Peru.

⁶ A. Hamilton Rice (From Quito to the Amazon via the River Napo, *Geogr. Journ.*, Vol. 21, 1903, pp. 401-418) quotes the usage of the Brazilian and Peruvian voyageurs, who apply the name Amazon to the stream from the junction of the Ucayali and the Marañon, 100 miles above Iquitos. The historical aspect of the question is very fully discussed in H. J. Mozans: *Along the Andes and Down the Amazon*, New York and London, 1912, pp. 466-467.

America there occur, at altitudes between 3,000 and 3,500 meters (10,000 and 11,500 feet), open wind-swept plateaus, termed *páramos*, corresponding in character to the fell-fields of northern latitudes.⁷ They are highly specialized plant provinces, exhibiting many rare and curious types, most distinctive amongst which are scattered tufts of cushion-like growth and dwarf trees with flattened or umbrella-shaped tops. Various flowering alpine species are also found here. The *páramos* are almost continuously enveloped in mists and at certain seasons are subjected to icy, driving rains and sleety blasts, against which, in conjunction with the low temperature and rarified atmosphere, the traveler must battle for very life. Every year these lofty tracts claim their toll of victims.

After climbing to its maximum elevation (3,260 meters, or 10,696 feet), the road became much easier, as it traversed a succession of *cuchillas*, or knife-edge ridges. These *cuchillas* are a common feature in the configuration of the Andes: in longitudinal contour they are normally level or gently undulating. From bases of varying widths they rise, with a rapidly increasing degree of acclivity, to elevations of several hundred meters, until at the top they may not exceed one meter in cross section.⁸

Then we again mounted into the frigid, desolate wastes of the *páramos*, and for long we moved, as without motion, in a "wan, chill world," lost in a pallid veil of mist—a world bereft of hue and form, wherein alone reigned

Night, the shadow of light,
And life, the shadow of death.

It was late in the day when we gained the last summit on the Cerro de Matala (3,000 meters, or 9,840 feet), and a long and precipitous descent lay ahead. The road here had plainly had its beginning in a natural drainage depression and was still little more than a deeply scoured gully, extremely narrow and tortuous. As we went valleywards woods appeared, and these, lower down again, attained the proportions of high forest. The bed of the trail changed at the same time from bare rock and loose stone to earth and mud, with boggy pockets of uncertain depth. With every step we sank into the wet soil, often stumbling in the failing light against knotted superficial roots and tangled vines and creepers. After about two hours' going under such conditions, trusting wholly to the instinct of our animals, we reached our day's destination, Sabanilla. At the one house which made the place we were hospitably received and served with a welcome supper of roasted plantains, boiled yuca (manioc), and *guayusa*—the last an infusion of the leaves of a plant (*Ilex sp.*) similar to the *maté de Paraguay*, or Paraguay tea.⁹

⁷ Cf. E. Warming: *Ecology of Plants* (English edition by Percy Groom and I. B. Balfour), Oxford, 1909, pp. 258-259. See also *Belts of Vegetation in Peru*, Fig. 74, p. 123, "The Andes of Southern Peru," by Isaiah Bowman, New York, 1916.

⁸ For an explanation of their origin see Alfred Simson: *Travels in the Wilds of Ecuador, and the Exploration of the Putumayo River*, London, 1888, pp. 96-97.

⁹ The *guayusa* is a true holly (*Ilex*), allied to the *maté*, or Paraguay tea (*Ilex paraguayensis*), but with much larger leaves. Spruce, *op. cit.*, Vol. 2, p. 453.

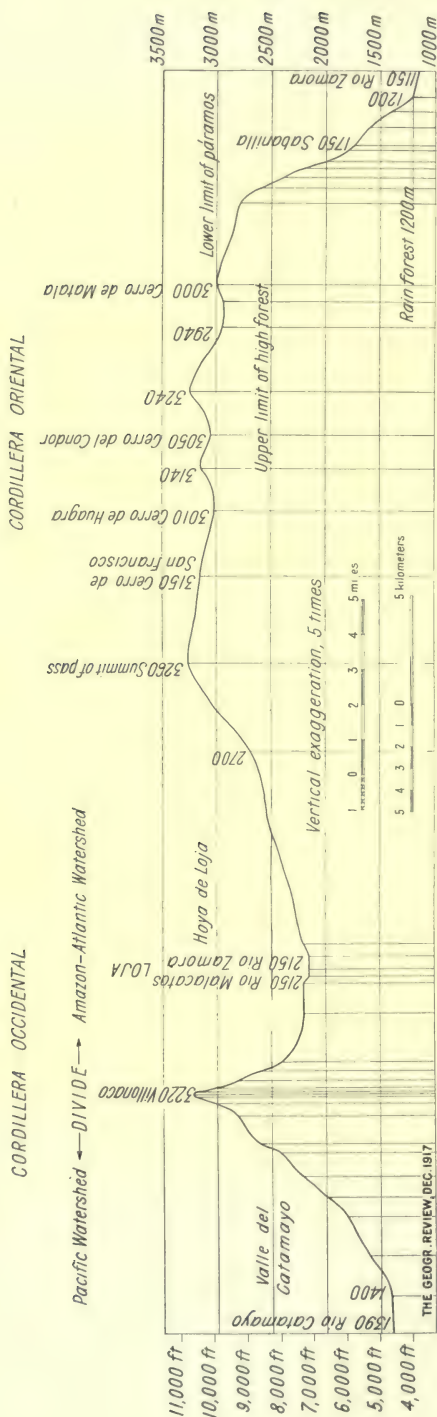


FIG. 2.—Approximate transverse profile of the Eastern and Western Cordilleras of the Andes in southern Ecuador on the line indicated on Figure 1 roughly at right angles to their axes through Loja (latitude 4° S.). Horizontal scale, 1:350,000; vertical scale, 1:70,000.

From the trail on the open mountainside, dropping to the Rio Sabanilla five hundred meters below, morning showed us a scene of surpassing grandeur—a stupendous array of splendid heights, encompassing a multitude of peaks, escarpments, spurs, and ridges, over all of which was spread the mantle of a virgin tropical vegetation, softening every outline, delicately fringing every crest. Immediately below us, to the south and west, lay the valley of the Rio Sabanilla; and far through the widening hills, trending southward and eastward, we could trace the meandering course of the Rio Zamora.

Coming to the Sabanilla, which we crossed by a wooden bridge, we could see its meeting with the Zamora. The road now led towards the latter river, whose channel, broken by numerous falls, it followed all the way on. Many mountain rills came tumbling down the ravines in glistening cascades. More often they ended in clear shady pools near the trail; but now and then they developed into deeper *arroyos*, or intermittent streams, which had to be forded. These offered no serious impediment at the time, but upon our return some weeks later, when the seasonal rains had converted them into turbid torrents and landslides had buried the road under avalanches of débris, we suffered more than one awkward hold-up.

Much of the path was through lofty forest—true tropical rain-forest—embracing a luxuriant diversity of character in its successive stories of vegetation, beginning with the clean moisture-saturated “floor” of humus, carpeted with mosses, ferns and other shade-loving types, rising to groups of herbaceous growth with large variegated foliage and dark-green glossy-leaved shrubs, mixed with graceful tree ferns and slender palms, to its culmination in tall great-trunked trees, their branches draped with hordes of epiphytic plants, vines, and lianas.

At a distance from Sabanilla of about nine miles we came to an open grassy knoll, La Toquilla, so termed from the occurrence there of a cluster of the plant that goes by that name in Ecuador. The *toquilla* (*Carludovica palmata*) is a peculiar stemless species. From its aerial roots spring long slight stalks bearing the fan-shaped leaves. These leaves are the material from which the so-called Panama hats are made.

At mid-day we arrived at Zamora, which place, although always shown on maps of Ecuador in large print (presumably because of the historic interest of the name), consists of nothing more than a few dilapidated palm shacks, the remnant of a former Ecuadorian colony. I say “Ecuadorian” in contradistinction to Indian, because no Jíbaros live there, nor indeed do they usually come so far up the river. Zamora was once, like the lost cities of Mendoza, Sevilla del Oro, and Logroño,¹⁰ one of the richest settlements of the conquerors of the New World. In the year 1599 the latter three were totally destroyed by the Jíbaros, whom the Spaniards had never been able completely to subjugate. Zamora, also ruined, was revived for a time, to be finally abandoned in 1622.

Neither here nor anywhere else could I glean the least confirmation of Villavicencio's statement as to the alleged discovery, by a contemporary governor of Loja, of “magnificent remains” of the erstwhile city of Zamora.¹¹ So far, indeed, as I could learn, no vestige of its existence had ever come to light, and its site remained unknown. I passed twice on the Rio Zamora within a few miles of the precise geographical position he assigns to the place,¹² and it seemed incredible that, if any ruins were there or thereabouts, they should never have been found by the inhabitants of the locality. The testimony of Wolf, writing thirty-four years after Villavicencio, was that no traces of the once famous city of Zamora had ever been discovered;¹³ so that the latter's story may be regarded as romance.

¹⁰ Manuel Villavicencio: *Geografía de la República del Ecuador*, New York, 1858, pp. 87, 156, 276, 277, 419, 420, 425; Simson, *op. cit.*, pp. 53-54; C. R. Enock: *Ecuador: Its Ancient and Modern History, Topography, and Natural Resources, Industries and Social Development*, London, 1914, p. 340.

¹¹ “el Zamora, que vió florecer la ciudad de su nombre i cuyos magníficos restos han sido últimamente descubiertos por el gobernador de Loja.” *Op. cit.*, p. 156.

¹² “En el año de 1548 erijieron los españoles esta provincia en gobierno, y el año de 1549 se hizo la fundación de la ciudad de Zamora, entre los rios Zamora y Yancuambi, en 4 grados de latitud meridional y 30 minutos de longitud occidental.” *Op. cit.*, p. 278. (This longitude has reference to the meridian of Quito.)

¹³ “Geografía del Ecuador,” p. 31, footnote.

The place now called Zamora marks the fall-line of the river. Its elevation at this spot is 1,000 meters (3,280 feet); at Loja it is 2,150 meters (7,050 feet), thus giving in the 100 kilometers between these points a virtual gradient of 1.15 per cent.

Just after leaving Zamora we crossed the Rio Bambuscara, flowing into the main stream on the right from the south. Several miles farther brought us to another river, the Jamboé, also entering the Zamora from the south. On the other side of it we came to the abode of a white man, a native of Loja, who had opened up a little estate in these remote wilds. By his courteous invitation I made his house my headquarters while I was on the river.

Shortly after our arrival a number of Jíbaros of both sexes issued in single file from a cane-field bordering the river and approached the house. They had been employed in various agricultural tasks about the place and were coming for their daily pay, which they took in goods, money being unknown to them. The men were rather under middle height, thick-set, and with broad, well-developed chests and large hands and feet. They had mahogany-tinted skins and tolerably regular features. Several of them had their teeth stained black. The men wore their hair, which was long, black, and straight, in a fantastic mode, with two locks, twisted like pig-tails and bound with cotton or fiber, depending from the forehead just in front of the ears; while about the tops of their heads were stuck tufts of bright-colored birds' feathers and small wooden combs. In another matter of decoration they follow a custom common to several tribes of the Upper Amazon basin:¹⁴ the lobes of their ears were pierced, and in them were inserted sticks of bamboo, about half an inch thick and about eight inches long, the anterior ends of which, in some cases, had feathers fixed in them. Their faces were hideously smeared all over with anatto, a brick-red pigment obtained from the seeds of the plant *Bixa orellana*.¹⁵ They had no beards, but only a few hairs on the upper lip. As I afterwards learned, depilation is generally practiced by the Jíbaros.¹⁶ The clothing of the men consisted of a piece of a coarse cotton fabric, of a uniform striped pattern dyed a dull reddish-brown, about three feet wide, worn like a kilt and tied about the waist with a girdle of fiber. The dress of the women was the same, but with the addition of another piece of similar material thrown over one shoulder and there fastened in such a manner as to hide the breasts. Their faces were not painted as the men's, but some of them had an ornament consisting of a bit of stick, of the size of a match, projecting horizontally from a hole made in the underlip.¹⁷ The women were very

¹⁴ Cf. A. Hamilton Rice, *op. cit.*, p. 409; Thomas Whiffen: *The North-west Amazons*, London, 1915, p. 85; and W. E. Hardenburg: *The Putumayo, The Devil's Paradise*, London, 1912.

¹⁵ H. A. Alford Nicholls: *Tropical Agriculture*, London, 1906, p. 244. This plant is figured in Plate 42 of Captain Whiffen's book quoted above.

¹⁶ Whiffen, *op. cit.*, pp. 273, 282.

¹⁷ A. Hamilton Rice: *The River Uaupés, Geogr. Journ.*, Vol. 35, 1910, pp. 682-700; reference on p. 695; Whiffen, *op. cit.*, p. 86.



FIG. 3.



FIG. 4.

FIG. 3—The Plaza in Loja. The Cordillera Oriental in the distance.
 FIG. 4—The Río Zamora at Loja.

small in stature and physically not prepossessing. Their hair was dirty, dishevelled, and neglected, and, but for a circlet of tape, unadorned. They wore rude necklaces, armlets, and bracelets of berries, nuts, seeds, and shells, and the skulls and beaks of small birds, strung on fiber thread.

Within a radius of several miles from Jamboé there were several Jíbaro houses, each standing alone in a separate clearing a little way back from the river, with a belt of forest interposed, so that they were effectually concealed from view from the water. All were exactly alike—rectangular in plan, with rounded ends, about 60 feet long by 30 feet wide, and constructed of bamboo on a framework of big poles lashed together with lianas. At either end was a door of solid wood, usually kept securely bolted on the inside. The roof was high-pitched and made of palm thatch. Several families of blood relations lived together in one house. There was no partition between the quarters of the men and those of the women, as Orton and others have noted as a detail of the dwellings of the Indians (Záparos) on the Napo and other rivers of the Oriente province of Ecuador,¹⁸ but the rear portion was always allotted to the females. The only noticeable difference between the two ends of the house consisted in the sleeping arrangements, which, in the case of the men, were simply low tables or platforms of split bamboo,¹⁹ with a superimposed skeleton frame; while the women had covered booths or cubicles. When the regular accommodation of this kind was inadequate to the occasion, men, women, and children reposed in groups, sexes apart, on mats of cane or rush laid on the earth floor. Immediately before each one of these sleeping places a fire was kept burning all the time, day and night. In front of each platform, and at the same height, there was a heavy pole, fixed horizontally in two forked sticks, serving as a rest for the protruding feet of the sleepers, who seemed to delight in toasting them over the glowing embers, indifferent to the flames and sparks that leapt from a fresh blaze. About the middle of the building, suspended from the roof-poles by cords of liana or strips of flexible bark, were trays for holding earthenware pots, bowls, and other household utensils; and fastened to the posts supporting the ridge-pole were woven cane baskets, containing the men's finery—necklaces of berries and seeds of various kinds, and of the bored canine teeth of monkeys (*Cebus*), and decorative tassels of the feathers of Cuvier's toucan (*Ramphastus Cuvieri*) and the iridescent wing-cases of certain beetles (*Chrysophoxa chrysochlora* and *Euchroma gigantea*). Hunting paraphernalia—quivers, poison-pots, etc.,—were hung on the frames of the sleeping platforms, and blow-pipes were kept, for safety, tied against the main posts of the building. The *bodoquera*, or blow-pipe, whose manufacture has been described by Simson,²⁰ was from eight to ten feet in length. The darts

¹⁸ James Orton: *The Andes and the Amazon*, New York, 1876, p. 171.

¹⁹ Whiffen, *op. cit.*, p. 47, reports that the Apaporis Indians make shelves or platforms on which they sleep.

²⁰ *Op. cit.*, p. 155.

used in it were about ten inches long, a little over one-sixteenth of an inch thick in the middle, tapered to a fine point at either end and made out of the rib of the leaf of the *chonta* palm (*Bactris ciliata*). These were held in a quiver fashioned out of a length of bamboo, to which was fixed a spherical gourd, filled with the very light floss of the silk-cotton tree (*Eriodendron anfractuosum*) for tipping the darts to fit the bore of the blow-pipe.²¹ The poison-pot was made of half of a small gourd and had a cover or lid attached to it. The poison was a thick, black, viscous compound, its principal ingredient being the juice of the plant *Strychnos toxifera*. Captain Whiffen speaks of the use of the same poison by the Huitoto tribe of the Issa (Putumayo) and Yapurá Rivers.²²

Yuca of the bitter variety (*Manihot utilisima*), maize (*Zea mais*), plantains (*Musa paradisica*), and ground-nuts (*Arachis hypogaea*) were cultivated for food, each house having its own garden plot in the same clearing, as well as a larger plantation some way off. Yuca and plantains were mostly eaten boiled. From the former the intoxicating liquor *chicha* was made. The method of its elaboration is not nice. The peeled or scraped tuber, after being boiled, is masticated by the women and set aside to ferment. For drinking, some of this unsavory mess is put into a shallow



FIG. 5—Jíbaro Indian standing under a wild cacao tree (*Theobroma cacao*) at Jamboé, Rio Zamora. (Photo by the author.)

²¹ Cf. H. W. Bates: *The Naturalist on the River Amazons*, *Everyman's Library* edition, London, 1914, p. 302.

²² *Op. cit.*, pp. 144-145.

receptacle full of water and worked and stirred with the fingers until the whole is well assimilated. The coarser fiber, as it comes to the surface, is picked out, and the "cup," generally a calabash about a foot in diameter, is then ready to be passed round. To avoid giving offence, I had to take, or feign to take, a sip upon many occasions.

Great quantities of *chicha* are imbibed at Jíbaro feasts, a unique feature of which is that the host entertains vicariously, some other member of the

house being appointed to represent him, while he wanders in Elysian fields under the influence of a narcotic made from a vine called *aya-huasca* (Inea, "dead man's vine"; *Banisteria caapi*, Spruce).²³

Meals seemed to be going on at odd hours throughout the day. The only regular refection was the morning one, which was served at day-break. The food, done up as an "olla podrida," or "hot-pot," and contained in a large earthenware caldron, was brought on by the women, who would then retire to eat with the children in their own part of the house.²⁴ Jíbaro table manners were of the kind made memorable by the feat of the ingenuous Little Jack Horner—but the Jíbaro pot might hold greater surprises than plums.

The women were kept much to themselves and never ate with the



FIG. 6.—Jíbaro head ornaments, made of (1) feathers and (2) wing-cases of beetles.

men. Their particular concerns were the preparation of the food for the household and the care of the young children. They also performed all agricultural labors after the ground had been cleared. Added to their lot, again, was the making of earthenware vessels; and the results of their handiwork in this way were remarkably good, considering that they were ignorant of the use of the potter's wheel.²⁵ Most houses also had rude apparatus for spinning and weaving cotton, work which, however, came within the province of the men.

Although wild cacao trees (*Theobroma cacao*) were abundant on the Zamora, the Jíbaros did not appear to have any practical knowledge of the alimentary value of the fruit, for there were many trees to be seen along the river with pods rotted on them. Rubber trees (probably *Sapium verum*, Hemsl.) were also common enough, and the latex, obtained in the

²³ *Op. cit.*, Vol. 2, pp. 423-425.

²⁴ Cf. Whiffen, *op. cit.*, p. 135.

²⁵ Cf. Whiffen, *op. cit.*, pp. 95-96.

usual way by making incisions in the trunk, was utilized in various native articles. In this part of Oriente there were no cattle, horses, mules, or burros. The Jíbaros kept pigs and fowls, but sustained themselves chiefly by the products of the chase.

After putting in some days at Jamboé, making friends with the natives and exploring the surrounding country, we made ready to proceed farther down the Zamora, our objective being a place called Chicaña, a day's journey on the river.

As all Jíbaro canoes are communal property, some parleying had to be done with the different chiefs before consent could be obtained to our use of one. The dug-out which we eventually got was navigated by two Jíbaros, hired for the trip, one standing at the bow and the other at the stern, and both having long poles for steering. No effort was required to move the canoe, as the current alone was strong enough to take it along at a good rate.

There were frequent rapids, some shallow and smoothly graded, others deep and strewn with great boulders and projecting rocks, making formidable obstructions among which the craft was maneuvered by the Indians with consummate skill and grace. On both sides of the river the forest came down to the water's edge, save where the low banks sloped away to wide sandy *playas*, marking the flood-plain.

At an estimated distance of between 25 and 30 miles from Jamboé we passed the mouth of the Yacuhambi (or Yanazambi, as Wolf calls it), a river of respectable size flowing into the Zamora from the northwest. Two or three miles farther on we came to the Rio Nanguipa, which discharged into the Zamora on the right. We landed on the opposite bank, at the solicitation of the canoe-men, for a rest at a nearby house to which they conducted us. In it were several Jíbaros, none of whom evinced the least concern at our appearance, even giving me, a white stranger, only a casual glance.



FIG. 7—(1) Jíbaro necklace of berries and nuts, (2) Jíbaro hand-made earthenware bowl.

Very curious are the ceremonial conversations (or perhaps, more correctly, monologues) which these Indians exchange, as a preliminary to any natural talk, whenever and wherever they meet. The speaker never looks at the individual addressed but allows his eyes to wander all around with an odd air of nonchalance; while the other accents the oration, as it were, by the constant utterance of deep-throated grunts or short, sharp, rapidly repeated ejaculations, translatable, according to one authority,²⁶ by the Spanish expressions *sí, no, bueno, como no, así es*. And every now and then the hearer expectorates in a manner suggestive of contempt, disgust, or defiance, or indulges in that peculiar clicking of the tongue habitual, it would seem, to all Amazonian tribes, whatever the action may denote.²⁷ The voice in these effusions is always pitched very low, so that it acquires a ventral timbre, and the hand, with fingers bent in toward the palm, is frequently held in front of the mouth, presumably for acoustic effect. As the harangue proceeds it gathers in strength and vehemence of delivery like the crescendo of a swiftly on-coming storm, while apt emotional gestures and pose lend to the performance a fitting dramatic touch. Then the other holds forth in like manner, and, if several be present, each one has his turn. I listened to many of these extraordinary and really impressive declamations, but never succeeded in learning anything as to their subject or import. Of the few writers who have dealt at all with the Oriente of Ecuador, only one, so far as I am aware, namely, the Rev. Father Vacas Galindo (best known by his map of the republic),²⁸ makes any mention of these ceremonial speeches. But Captain Whiffen's work, to which numerous references have already been given, presents some interesting analogies in the languages and peculiarities of speech of the tribes of the Issa (Putumayo) and Yapurá Rivers.

A considerable time was thus consumed at the house which we were now visiting. The drinking of *chicha* followed, and, after a decent interval, during which I distributed some presents of gunpowder and shot, small mirrors, beads, and other trifles, we took our departure.

The remainder of the voyage was without incident of any special interest, and at sunset we reached Chicaña. The river at this point was more than 300 feet wide, and the last of the bad rapids had been passed some miles above. On the left was the mouth of an *arroyo*, and into this the canoe was poled, hauled up out of the water onto a bank of shingle, and made fast by a vine rope. A trail which we then took, crossing and re-crossing the sinuous bed of the stream many times, finally brought us to a house. Its extreme seclusion I suspected to be due to the proximity of the Rio Bomboiza and its tributary, the Gualaquiza, with the dwellers on which

²⁶ The Rev. Father Enrique Vacas Galindo, O.P., in his work "Nankijukima," published at Ambato, Ecuador, in 1895. The title is the name of a Jíbaro chief of whom the author writes.

²⁷ Cf. Simson, *op. cit.*, p. 94; Whiffen, *op. cit.*, p. 249.

²⁸ Mapa geográfico-histórico de la República del Ecuador, por el R.P. Fray Enrique Vacas Galindo de la Orden de Predicadores, 1:1,500,000, Quito, 1906.

the Zamora Indians were not on the best of terms. Here we spent several days.

On one of our forest excursions we encountered an old clearing, amidst whose rank weed growth stood a deserted habitation. Its late possessor was dead, and it was the custom, I learned, whenever the head of a family died, for the surviving members to abandon the place to the deceased for his tomb, building another house for themselves elsewhere. Peering through the interstices of the crumbling structure, I could see a mummy-like bundle of palm leaves, in which was the corpse, propped up against one of the roof posts, while set close by were vessels containing yuca, plantains, and other edibles, so that the departed might not suffer the pangs of hunger upon his entry into the other life. Captain Whiffen describes a form of intramural burial in which interment is made just beneath the floor of the house, which continues to be occupied. A similar form, in which the house is abandoned, is mentioned by Hardenburg²⁹ as in vogue among the Huitotos of the Putumayo.

From Chicaña we started back up the river. The first day we got as far as Nanguipa, where a short stop had been made on the way down. On account of the presence of a medicine-man, called to cure a sick woman, many people were gathered at the house. Amongst them were several chiefs with all the insignia of their rank—faces painted and patterned, hair decked with bunches of gaudy feathers, and chests covered with loops of necklaces.³⁰ At nightfall the shaman, ensconced behind a screen of plantain leaves in the center of the house, began his magic rites. Preluded by an incantation with a not unpleasing rhythmical refrain, to the bizarre accompaniment of rattles and beating of palm branches, came furious blowings and groanings, wonderful ventriloquial effects and guttural noises most appalling—all in the regular sequence of a constantly recurring cycle throughout the night. For hours I listened to the unearthly din and through the murky, smoke-laden air watched the strange shadows cast by the flames of the smoldering fires. When daylight came to end his long vigil, the medicine-man, by the potency of his exorcisms, had drawn out the evil spirit, in the material form of a feather, from the shoulder of the patient.

After a late breakfast in the confusion of the crowded house, we got away from Nanguipa, and went on up stream. Our progress in this direction was very different from what it had been coming down with the current, and continual hard poling was necessary to make headway against it, while the negotiation of the rapids was particularly laborious. When possible, the canoe was kept close in to the bank and its propulsion aided by hauling on the adjacent or overhanging forest growth, but the conformation of these fluvial barriers sometimes compelled the crossing of them near midstream, where naturally it was always more difficult and hazardous.

²⁹ *Op. cit.*, p. 155.

³⁰ Cf. Whiffen, *op. cit.*, p. 81.

During the afternoon we arrived at the mouth of the Rio Nambija, where we camped for the night; and the next day saw us back again at Jamboé.

The distance between Chicaña and Jamboé, computed by means of a prismatic compass traverse which I made of the river as we came up it, was about 70 kilometers (43 miles). The tributaries of the Zamora which we passed were (in down-stream order): the Timbara, Cumbaraza, Nambija, and Nanguipa on the right, and the Yacuhambi on the left. In Wolf's map of Ecuador³¹ these rivers are correctly named and placed with relation to the Zamora, but the course of the latter on the stretch in question is quite wrong, being shown as southeast, whereas it is actually northeast.

The Zamora, like all the other rivers coming from the Cordillera Oriental, is auriferous,³² and the Jíbaros have some idea of gold washing. A few grams of the metal which I got from one of them had been amalgamated, but how I could not discover. Mercury for the purpose may have been obtained from Loja or Gualaquiza,³³ or it may have been found in the alluvial deposits of the region, as it sometimes occurs, in a disseminated state, in such formations.³⁴

The mean temperature at Jamboé was approximately 22° C. (71.6° F.). The diurnal variation was small but sufficient to render the nights agreeably cool. The atmospheric humidity was probably high. The annual rainfall I judged, by the aspect of the vegetation and other indications, to be between 80 and 90 inches; and this was evenly distributed, there being no well-defined wet and dry seasons.³⁵

Despite the low level of their development, the Jíbaros of the Zamora, like those of other parts of the province of Oriente, are by no means an unintelligent people, and in the conditions of their simple life they are valorous, faithful, and industrious. The Jíbaros are not, and never have been, cannibals.³⁶ Their barbaric art of shrinking and conserving the heads of enemy chiefs slain in war has no connection with anthropophagy. I saw no specimens of the former but quote Simson's description of it:

They [the Jíbaros of the Pintuc] have a most perfect and finished method of scalping, by which the victim's head is reduced to the size of a moderately large orange, maintaining tolerably well all the features. Only the lips, point of the nose, and all the thicker fleshy portions, of course, acquire too much prominence. To produce these ghastly objects, the skin is cut round the base of the neck, and the entire covering of the skull removed in one piece. This is then dried gradually by means of hot stones placed inside it, until the boneless head shrinks to the required size.³⁷

³¹ Carta geográfica del Ecuador, 1:445,000, Leipzig, 1892. Nominally, Dr. Wolf's book, cited in footnote 1, is intended "to accompany and explain the map."

³² Wolf, *op. cit.*, pp. 310 and 597.

³³ A town of Oriente inhabited by whites. See inset on map, Fig. 1.

³⁴ *Ibid.*, pp. 253 and 314.

³⁵ At Napo, 3° farther north, there are no distinctly wet and dry seasons, but most rain falls in May, June, and July. Orton, *op. cit.*, p. 198.

³⁶ Villavicencio, *op. cit.*, p. 360.

³⁷ Simson, *op. cit.*, pp. 90-91. Compare the custom among the Mundurucus of the Tapajoz, described by W. C. Farabee: The Amazon Expedition, *Univ. of Pennsylvania Museum Journ.*, Vol. 8, 1917, pp. 136-137.

The tribe have no outwardly manifested religious beliefs, other than such as may be involved in the cult of the medicine man. Occasionally individuals would be met who had been baptized, as adults, at Gualaquiza, but they were not professing proselytes. The missions founded in various Amazon regions, from the sixteenth century down to the present day, have made little or no real impression upon the Jíbaro, where he has been reached at all by them;³⁸ but this is scarcely a matter for wonder, in view of the interruptions which they have constantly suffered through the stormy vicissitudes of South American history. "The first blow to the missions," says Mozans,³⁹ "came when the Jesuits were expelled from the Spanish colonies in 1767 by Charles III for reasons *ocultas y reservadas*. The second was delivered a few decades later by the leaders of the War of Independence, when members of other religious orders were driven from the scenes of their missionary labors. Since then, owing to the constantly perturbed condition of a greater part of the continent and the crippled financial condition of most of the republics, little has been done for the Indians in the vast territories watered by the Amazon, the Orinoco, and their tributaries; and, as a consequence, many tribes that had, under the missionaries, made such notable advances in civilized life, have lapsed into barbarism and returned to their former wild life in the recesses of the forest." Thus, some twenty years ago the Franciscans established a mission, with schools and a medical dispensary, at Zamora, but after a brief existence its withdrawal was forced under the anti-clerical President Alfaro, during whose régime also the Jesuits were deprived of all authority in Oriente.

On the way back to Loja difficulties with the conveyance of my botanical and other collections necessitated a halt at the Rio Bambuscara, a short distance from Jamboé. The next day's stage, which was also troublesome owing to landslides and swollen *arroyos*, brought us to Sabanilla, where fresh transport arrangements had to be made, entailing a stop of two days. A dawn wet and lowering augured ill, I thought, for the journey over the Cordillera; but the muleteer predicted a good day. Before we had achieved the toilsome ascent of the Cerro de Matala the rain ceased, and we traversed the dreaded *páramos* in fine weather, and by six o'clock in the evening were clattering over the cobbled streets of Loja.

A week later, seaward bound, I turned on the road, under the shadow of Villonaco, to look back again upon the sunlit city below. Aloof and solitary it stood, on the threshold of a primitive world,—a last outpost of the civilization which gave it birth; for only the span of the Andes separated it from the domain of a savage race whose state was still the same as that in which the *conquistadores* first found it nigh upon four centuries ago.

³⁸ Cf. Simson, *op. cit.*, p. 87.

³⁹ H. J. Mozans, work cited in footnote 6, p. 451.

THE YURACARÉ INDIANS OF EASTERN BOLIVIA*

By LEO E. MILLER

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While we were at Todos Santos in August, 1915, there appeared one day the Indian guides that Padre Fulgencio had promised to send to conduct us to his mission kingdom among the Yuracarés; we thereupon packed into canoes such of our equipment as was necessary for the trip and started across the brown water of the Chaparé. On the other side of the river there was no clearing; the trees grew down to the water's edge; and the moment the canoes were left behind we plunged into the perpetual gloom of the forest. An indistinct trail led into the heart of the jungle. The Indians adjusted our belongings on their backs, securing them with broad strips of bark placed across the forehead; then they set out at a good pace. A number of women and children carrying boiled yucas and plantains trudged along in the rear of the procession.

There was not much undergrowth, but the ground, from which there is little evaporation on account of the dense canopy overhead, was very muddy. Every few rods we came to a deep streamlet which had to be crossed on the trunks of fallen trees; some of these slimy bridges were sixty feet long and almost impassable to us, but the Indians strode across as unconcernedly as geckos. Half-way to the mission the Indians stopped for lunch and a short rest, and by noon we reached the edge of the clearing, having covered a distance of twelve miles. After a tramp of half a mile through weedy fields of maize and yucas, we reached the mission buildings—a few dozen low, grass huts clustering around an open square. At one end rose two structures of large size which served as the church and general meeting place. Near the center of the clearing a stately cross had been erected, hewn from the heart of a giant *ceiba*.

The priest was delighted to see us and spared no effort to make us comfortable. We were soon installed in a room of one of the buildings which served as a boys' dormitory, and a short time later started out to inspect our surroundings. At first the Indians were reticent and would peer at us from a distance; this was true particularly of the children, but as the days wore on we made friends with them, and from both the people and the priest we learned a great deal about their history and habits. The name Yuracaré, according to d'Orbigny, was given to them by the Quechuas, and means "white man"; this name is not especially appropriate, as they are of a

* This is the second of two articles by Mr. Miller, of which the first, "Across the Bolivian Highlands from Cochabamba to the Chaparé," appeared in the October number of the *Review* (Vol. 4, 1917, pp. 267-283).

decided brown color, although perhaps averaging lighter than the Quechuas; they were first discovered by Viedma in 1768.

At the present time, at least, the Yuracarés are a people of the hot, humid lowlands. Those who have not been captured and brought to the missions, or who escaped the unenviable fate of having been taken from their forest home by private "slaving expeditions," live along the smaller branches of the streams which eventually find their way into the Mamoré; this includes particularly the Chaparé, Chimoré, Ichilo, and Isiboro.

There were about four hundred Indians residing at the mission. Although attempts have been made intermittently for more than a hundred years to civilize these people, there were long intervals when the work had to be abandoned, and the families returned to their homes in the wilderness. Nearly all of the present aggregation have been brought together during the last few years. Newcomers are added to their number frequently. The priest, learning of other families far up some unmapped *quebrada* or streamlet, takes a few of the men who have learned to place confidence in him and whom he trusts, and starts forth on a long canoe voyage in search of them. The party approach the hidden dwelling suddenly, surround it, and persuade the occupants to accompany them immediately, giving them only an hour or two in which to collect their few belongings. Occasionally the Indians that are sought for learn of the approach of the emissaries, hide before their arrival, and render the long trip of no avail. When the expedition is successful and the families have departed to the waiting canoes, their huts are burned and the plantations destroyed. Knowing that neither home nor food have been left behind, they are not so apt to run away from their new quarters and go back to their old dwelling places.

The Yuracarés are a tall, well-built people of a rather docile disposition; however, the older generation never becomes wholly reconciled to the new mode of life and remains at the mission only for reasons which I will mention later. In their wild state they live in small, family parties, obtaining their subsistence from the forest, which abounds in game, and from their fields of yucas. Their native costume is a long, shirtlike garment (*tipoy*) made from the fibrous bark of a tree. At the mission, this has largely been replaced by cotton clothes. Each family has been provided with a separate hut of adequate size, where the parents and very small children live. The boys and girls over five or six years of age are under the constant supervision of the priest and attend his classes; at night they sleep in separate, locked dormitories, which prevents their returning to their homes, and also keeps the parents from running away, as they will not leave without their children. Padre Fulgencio explained that this arrangement also keeps the children from observing and copying the customs of their elders. He recognizes the impossibility of reclaiming the forest-reared savage and devotes practically all his efforts to the younger generation.



Fig. 1—Yuracaré Indians operating a home-made cane-mill.

The Indians marry at an early age, the boys at sixteen and the girls at fourteen. In their wild state each family rears four or five children; at the mission, never more than two, and frequently none at all. Should the first-born be a girl, she is permitted slowly to starve to death; the priest has inflicted severe punishment upon the parents in his efforts to break this custom, but so far all his work in this direction has been in vain.

So far as possible the Indians are discouraged in the celebration of their native festivals, but it frequently occurs that the entire populace appears with faces gaily decorated with black and blue dots, and all join in weird songs and dances the purpose of which remains a secret, as they cannot be induced to tell. They worship no divinity, being in this respect in a class almost by themselves.

Food at the mission is abundant. The clearing comprises several hundred acres and is planted in maize, rice, yucas, plantains, and sweet potatoes. Like most savages, these Indians have an intoxicating drink (*casiri*). It is made of the boiled root of the yuca. The women dig great quantities of the roots; peel and thoroughly cook them, after which a certain portion is chewed and expectorated into huge earthenware jars; the remainder is mashed and thrown in also, and water added. The following day fermentation has started and the greenish-yellow liquid is ready for use.

At the mission the Indians have learned the use of salt, and this fact perhaps as much as any induces them to remain, for, deprived of it, they cannot long exist. A small amount is given to each individual at stated periods, just enough to supply his wants until the time for the next distribution. There are instances on record where families have escaped and gone back to their nomadic life for eighteen months, then returned voluntarily to promise future obedience, so great was the craving for salt.

The rites attending the death and burial of a man are among the curious and persistent ceremonies of the Yuracarés. When the husband dies, the wife removes all her wearing apparel and casts herself upon his body, where she remains weeping and lamenting until the time of the funeral, which is a day or two later; all the women squat in a circle around the deceased, raise their voices in sorrowful wails, and recount his good qualities and heroic deeds. The men drink *casiri* and dig a deep hole in the ground; when the time for the burial arrives, the body is carefully deposited therein, together with all the possessions of the deceased, and the wife's clothing is placed on top, after which the earth is thrown in.

The weapons of this tribe consist entirely of bows, five or six feet long, made of *chonta* palm wood, and various kinds of arrows. The shaft of the arrow is always composed of slender bamboo, but the points vary greatly; for large game there is a long, double-edged blade of another variety of bamboo; slender, barbed points of *chonta* are used for birds; and a long, sharp spike of palm wood for fish. This tribe is wholly ignorant of the use of the deadly *curare* poison.

We were fortunate in timing our visit to the Chimoré for the dry season. Additions were being made to the already large areas under cultivation, and for this purpose the Indians were cutting down forest. They were required to work four days each week, the remaining three being devoted to fishing and hunting. All the men and boys participated in this work and seemed to enjoy it thoroughly. At first the undergrowth was removed; this naturally led to the discovery of many strange animals, all of which were promptly brought to us for examination. The number and variety of snakes was astonishing; even after having spent years in a similar type of country, I had never suspected that so many existed; which shows how inconspicuous they are until one actually goes over the ground with a comb, as it were. Green boas were captured, several species of the fer-de-lance, and many others which we did not recognize. Some of them were poisonous. Among them was one which, in appearance, closely resembled the green boa, but its attitude was defiant and even aggressive; examination showed that it possessed long fangs. One day several of the men came running into our room and shouted "*Pisipi*." We followed them to the clearing and found that they had discovered a huge bushmaster coiled under a log. They tried to drive the reptile out with long poles, but it refused to move; finally the priest pulled the enormous creature bodily from its hiding-place with the aid of a hooked stick; it was very sluggish and made no attempt to strike. After shooting it, we found that it measured nearly seven feet in length and five inches in diameter. The fangs, over an inch long, emitted about a tablespoonful of yellowish poison.

The bushmaster, called *surucucú* in Brazil, is truly terrible. It grows to a length of ten feet or more and attains a great thickness. The ground color is reddish yellow crossed by black bands, sometimes forming a series of X's along the back. It does not take kindly to captivity and dies of starvation after a few months of confinement. It is one of the few snakes which are supposed to incubate their eggs. After selecting a hole in the ground, or in a stump, the reptile lays a dozen or more eggs; then it coils up on top of them and does not leave the vicinity until they hatch; at such times it is very irritable and will strike with deadly results any creature that disturbs it. The poison acts rapidly, and I heard of a case where an Indian died in less than half an hour after having been bitten.

There were also small brown salamanders, and lizards with spiny backs that resembled horned toads. Perhaps the rarest catch of all was a splendid example of the curious cane rat (*Dactylomys*), an animal seldom encountered on account of its rarity and secretive habits. It resembles a large rat, being twenty-five inches long and of a dark gray color; the toes are divided into pairs in order to enable it to climb slender stalks easily, and instead of claws it has nails. The pupils of the eyes are elliptical, like a cat's; when annoyed it uttered a hoarse scream, a sound which we had occasionally heard at night, but had not recognized.



FIG. 2.



FIG. 3.

FIG. 2—Yuracaré ready to start on a day's work in the forest.

FIG. 3—Yuracaré women and children.

After the brush had been removed for the distance of a hundred yards or more from the edge of the clearing, the Indians began to cut down the trees; some of these were of enormous size, especially the *ceibas*; one that I measured was twenty-five feet through the base, counting the supporting, bracket-like roots, and fifteen men hacked at it at the same time. When the tree fell, they set up a wild cheering and took great delight in watching this monarch of the forest tumble to the ground.

Three days of each week were devoted to hunting and fishing. Usually the Indians went many miles away, in small parties, returning promptly at the expiration of their allotted time. The children rarely accompanied them, and then only after having obtained special permission from the priest. Upon their return they brought baskets of fish and meat—enough to last until their next journey into the wilds. Nearly all fish and game were taken with bow and arrow. To secure the fish, they selected a small creek up the shallow water of which huge shoals went to feed and then shot them. After they had obtained a sufficient supply, they erected a framework of sticks, built a fire under it, and slowly roasted and smoked the fish; later they packed them in baskets between layers of green leaves for taking home. They also brought numbers of freshly killed animals for our examination for, in accordance with his promise, Padre Fulgencio had announced from the pulpit that all creatures taken by the hunters were to be shown to us first, and we were permitted to select any that were of scientific value. In this manner a number of peccaries, monkeys, and pacas were added to the collection.

The curl-crested toucan (*Beauharnaisia*) is a bird of the Amazon Basin that is seldom seen by travelers, even though they are naturalists and are making every effort to learn something of its habits. Bates records having seen many during his eleven years of exploration, and on one occasion he was attacked by a flock after he had wounded one of them. We therefore considered it an unusual streak of good fortune to find a large flock inhabiting a section of the forest within several miles of the mission. They were wary, nervous creatures, and spent their time in the top of tall trees, from which one of our men succeeded in shooting several with arrows before the remainder took alarm and flew away; they never returned to the locality. The bird is black above, with yellow underparts barred with black; the feathers on top of the head are flattened and curled, resembling shining scales, and are drawn together to form a ridge. On the throat and breast the brilliant yellow feathers are tipped with glossy black dots resembling beads of jet. Unfortunately the birds were not nesting, but the Indians reported having found their two white eggs in cavities in the taller trees. Another bird rarely encountered is the giant frogmouth (*Nyctibius*) which, while not so rare perhaps as the curl-crested toucan, is seldom seen, as it is nocturnal in habit and spends the days squatting horizontally upon some thick branch, where it resembles a gray lichen or is altogether invisible.

When the time for domestic cares arrives, the bird lays a single white egg on the branch which has served as its perch, or at the junction of a limb and the tree-trunk, without making any sort of a nest. Doubtless many eggs roll off of such a precarious spot and are broken. This bird feeds upon beetles and insects caught on the wing, and some observers say that it also catches small birds—a statement I am inclined to question. One specimen that we procured was twenty-two inches long, with an expanse of wings of thirty inches. The mouth when opened measured five inches from tip to tip of the bill and was three inches wide; but the esophagus was less than half an inch in diameter, which would prevent it from swallowing anything larger than a hummingbird.

The nights at the mission were always pleasant. The priest usually conducted a short service in the chapel, and then we sat on the veranda for an hour's chat, while the children romped and played before being sent to bed. Sometimes one of the boys brought out a queer drum; the ends were made of skin taken from the neck of a *jibirú* stork. He beat it in slow rhythm, swaying his head from side to side with each low thud. The girls placed their arms around each other's waists, forming lines of threes, and shuffled forward three steps and back, swinging their bodies all the while; suddenly they would whirl around once, take hold of one another's hands, and then the long line swept around at such a rapid pace that the individuals at the ends invariably were sent sprawling some distance away. After tiring of this, or any other pastime upon which they were engaged, they lined up and said "*Buenas noches, Padre*" in chorus. Then they ran away to the sleeping quarters.

After we had been nearly two weeks at the mission, we accepted the priest's invitation to accompany him on a short trip down the Chimoré. Twenty young men and boys were selected as paddlers; they started early one morning taking all of our personal luggage with them; a large number of girls and women followed soon after, carrying baskets of plantains, yucas, and other provisions. The missionary, my companion, and I brought up



FIG. 4—Yuracaré hunters wearing the *tipoy*, a long shirtlike garment made from the fibrous bark of a tree.

the rear, and encouraged along the few stragglers we met on the way, for the distance from the mission to the river is three miles through the virgin forest.

The Chimoré is of about the same width as the Chaparé, although the water is, in normal times, somewhat clearer. It rises far to the south, and is formed by the junction of the Blanco and Icona. Some distance below, it unites with the waters of the Ichilo, a mighty river which flows from the south through a solitary and unknown wilderness, and up which Padre Fulgencio had ascended a number of miles on a previous trip. In latitude $15^{\circ} 30' S.$ the Ichilo and Chaparé join and form the Rio Mamorecillo, which lower in its course is known as the Mamoré.

The meaning of Mamoré, which is a Yuracaré word, is "mother of the human race." The Yuracarés have a legend to the effect that, far away, at the source of the Sajta, which is the beginning of the farthest tributary of the mighty river, there are three rocks of pyramidal shape rising in terraces one above another, in the heart of which the stream has its source. In the beginning of things this mass of rocks gave birth to the first people, for which reason it is called "Mamoré." Later the name was also given to the river, because its water teeming with fish supplied them with food and offered an easy highway for the dissemination of the race.

Arrived at the point of embarkation, the men began to load the five canoes which were waiting, and the women built a fire and cooked luncheon. In a short time everything was ready and the canoes moved easily down stream. The paddlers were adepts at their work and, as a good deal of rivalry existed between the different crews, they kept up an almost continuous race, with the natural consequence that we made good time. The scenery along the Chimoré is exactly like that on the upper courses of the many rivers of tropical South America; there is the same monotony of yellow water highway, flanked by walls of deepest green. One thing that impresses the traveler as much as any other is the immensity of the silent, uninhabited areas; and also their comparative worthlessness. For days, and even weeks, one may enter deeper and deeper into the heart of the undefiled wilderness and see always the same dark forest, the hurrying, mysterious streams, and the rafts of low, threatening clouds; hear the annoying buzz and feel the poisonous sting of the insect swarms; and swelter in the humid, enervating climate. The greater part of this country can never be cultivated to any extent, as the annual floods cover it to a depth of many feet; there are few eminences safe from the inundations, and those few are of inconsiderable extent.

Our Indians were all well armed and frequently took long shots at some of the creatures which ventured to show themselves in the early mornings or just before dark. They were expert archers and even shot large birds on the wing as the flocks passed overhead. Occasionally an otter appeared, always a hundred yards or more away, swimming rapidly with only the head

showing above the water; these animals were favorite targets, and from my seat in the middle of the canoe I had an unobstructed view of the arrows in flight as they left the bow of the man in front; he did not aim at his prey but some distance above it. At the twang of the bow, the arrow sped into the air, ascending slightly at first, and then dropping as it approached the mark; it described a curve exactly like a bullet fired from a rifle and remained in a perfectly horizontal position during the entire flight.

When making camp on a sandbank, the Indians stick their bows and arrows in the ground, near the shelters; this prevents their being stepped on and broken. In damp or rainy weather the arrows warp badly, but it is only a few minutes' work to heat them near a fire and bend them back into alignment.

Tropical rivers are noted for their treachery. We had a striking example of this on the Chimoré. Camp had been made on an extensive sandbank one day at noon, as we planned to spend a few hours hunting and fishing in the neighborhood. The sun shone brightly and there was nothing to indicate a change of conditions in any manner whatever; but scarcely had we unloaded the canoes and built a fire over which we intended to do the cooking, when we were startled by a dull roar that grew louder with each passing second; before we had time to gather our belongings and throw them into the canoes, a foam-capped, seething wall of water was upon us, sweeping down the river and carrying away everything in its path. As the wave dashed over the sandbank, the imprisoned air shot up from the great cracks and rents in the sun-baked earth, and set the raging mass of muddy water a-hissing and a-boiling. In a few minutes there were only the higher mounds of sand projecting above the roaring current, and against them hungry tongues of water lapped greedily until their bases were undermined and the whole mass crumbled and disappeared in the seething flood. Where our peaceful camp had stood but a few minutes before, there was now a sea of agitated water. After this, the water was so muddy that it was unfit for use without special preparation.

Animals were not abundant on the river banks, although we saw a deer or a small flock of curassows at infrequent intervals. If we went into the forest a short distance, however, we were sure to find game in abundance. On one occasion the Indians demonstrated their skill at calling up monkeys. A large troop of cebus and squirrel-monkeys were feeding in the tree-tops, but for some reason the men did not give chase as they usually do; they concealed themselves in the thick, lower growth and whistled a few plaintive *kee-ooows* at frequent intervals. In a short time the animals began to evince a great deal of curiosity, and many of them descended to the lower branches; then the hunters shot a number before the band realized what had occurred and scampered away.

Large areas covered with an impenetrable cane jungle are scattered all along the borders of the Chimoré. The tall stalks rise to a height of fifty

feet or more and are beautiful to look at, but impossible to penetrate, until a trail has been cleared with hatchet or machete. The plant resembles the well-known sugar cane of our Southern States, but grows much taller, and the stems are thin and hard; a large, white plume crowns each stalk. This plant is of inestimable value to the natives. The long poles are used almost exclusively in constructing their dwellings, and the leaves make an im-

pervious thatch. Practically every stalk is infested with large, white grubs which live in the pith; these grubs, called *chata* by the Yuracarés, are extracted and used as bait in fishing. Many small runways perforate the matted growth; these have been made by capybaras, agoutis, and numerous other animals; even tapirs seem to appreciate the protection afforded by the thick cover and resort to it in the daytime, while jaguars noiselessly steal along the paths in the course of their nightly forages. One night we had an excellent illustration of how useful the cane plant, or *chuchilla*, as the Indians call it, can be in an emergency. We had landed on a sandbank rather early in the evening, spurred to this action by rapidly approaching black clouds, flashes of lightning, and the rumbling of distant thunder which bespoke the ar-



FIG. 5—Yuracaré boys at target practice. Arrows are shot into a small potato suspended from a tall pole.

arrival of a tropical rainstorm. At first it looked as if we should be compelled to endure a thorough drenching, but Padre Fulgencio issued a few orders to the canoe men and they hurried away to neighboring cane-brakes, with machete in hand; soon they returned dragging an immense quantity of the plant; four of the strongest poles were firmly planted in the sand to form a square, about fifteen feet apart, and the tops bent over and tied together with strips of their leaves; these served as the cornerposts of a shelter. Other stalks were laid across the top to form rafters, and firmly tied; the men then piled many more on top, binding each one to the rafters, until a complete hut had been built; although the height of the roof was fully eight feet, the ragged edges came down to the ground, entirely

enclosing the sides and forming a snug retreat against which the elements raged in impotent fury. After the first deluge subsided, other and smaller shelters were built; the Indians enjoyed the experience thoroughly; they threw aside all clothing, built fires over which fish and game were placed to roast, and squatted around the embers in a circle; doubtless indulging in pleasant reminiscences of the days before civilization with its restricting influences had come into their care-free existence.

Early next morning we were awakened by the reverberating howls of monkeys. The Indians rushed in a body from their shelters and, snatching up bows and arrows, ran in pursuit. A troop of red howlers had come to the *chuchilla* near our shelter; we could see none of the animals, but the tops of the canes waving as if agitated by a violent gust of wind told us of their whereabouts. Soon we heard shouts, and then the twang of bows, and the snarl of arrows as they ripped through the flesh of the luckless victims. This continued until the creatures disappeared in the interior of the dense jungle, and then the hunters returned dragging their quarry after them. We were eager to continue on our way, but in view of the efficient and willing service rendered by the men the night before, it was decided to wait a few hours and permit them to have a feast. A huge fire was built, and the monkeys, after having been skinned and washed, were set on spits to roast; the Indians crowded around, sang and shouted, and tore off and ate chunks of the half-roasted flesh; in a short time our orderly Yuracarés had returned to the realms of savagery, and were indulging in a performance such as I had repeatedly seen among the wild Nhambiquaras of Matto Grosso.

Lower down we saw numerous islands, some of large size and of a peculiar formation. The river, which had risen so rapidly a few days before, had gone down to its normal level and left these obstructions in the channel exposed high above the surface. A matted mass of logs and branches, of which a layer fifteen feet thick protruded above the water, formed the bases of the islands; on this, soil had gathered to a depth of five or six feet, and supported a luxuriant growth of vegetation. These islands are composed of deposits of driftwood which are left stranded on sandbanks during the season of high water, and while the edges are torn and jagged, the force of succeeding floods seems to be of insufficient strength to wash them entirely away. As we paddled along quietly near the banks the priest or the Indians pointed out many interesting and curious plants. One of these is the *palo santo*, or holy tree; it grows to a great height, but the trunk is comparatively slender. The peculiar name is derived from the fact that it is as carefully guarded as any sacred object should be, but in this instance by myriads of fire ants which live in the hollow interior of the trunk. If the tree is struck sharply with a stick, the ants pour out in endless files through minute openings; they are vicious insects, and the bite smarts and burns many hours after it is inflicted. The *tacuara*, a species of tall,

feathery bamboo, is another interesting plant of this region. When the stalk is cut down the leaves shrivel and dry within a few minutes. Large numbers of edible palms grew throughout the forest. The beautiful plume-shaped leaves droop in a great umbrella-like mass from the top of a column sixty or seventy feet high; thick clumps of straight, tough roots branch out eight or ten feet above the ground and form a solid support to the stem. A delicious salad is made from the tender leaves, folded up in the bud; or, if they are boiled, the flavor is similar to that of asparagus. To secure the bud it is of course necessary to cut down a tree, which has taken the greater part of a century to mature; but in a region where many millions of them are growing, the traveler is not inclined to be sentimental and only bemoans the necessity of an hour's hard chopping through the steel-like trunk before the coveted morsel is brought down.

The country between the Guapay and the Ichilo is probably as little known as any part of South America. This strip of land, covering approximately five thousand square miles, is heavily forested, and is the home of a tribe of savages known as the Sirionós. Judging from the accounts given to us by our canoe men and the priest, they must be a terrible and indomitable race. The Yuracarés fear them greatly, and, as we neared the Ichilo, they preferred to keep the canoes in the center of the river and seemed reluctant to land; if they shot at an animal and the arrow missed its mark and dropped in the forest, they did not go in search of it; a half day of careful work is needed to make an arrow, and, as a general rule, Indians are very careful to hunt for any they may lose; but in this instance, they preferred the loss of the arrows to risking their skins in the dense cover. Four of the Yuracarés at the mission, one a girl of twelve years, bore unsightly scars—the result of having been ambushed by parties of the Sirionó tribe; I was also told that occasionally some of the Yuracarés are killed by them. The Sirionós seem to have no permanent homes and cultivate the ground to a very limited extent, if at all. They are a tribe of wanderers and roam the forest in small parties, killing game for food. In appearance and stature they are not unlike the Guarayos, but in temperament they are totally different and have successfully resisted every attempt made to subdue them. Their weapons are bows and arrows; the former of great height and so powerful that they cannot be drawn with the arms alone. In order to shoot, the Indian throws himself on his back, grasps the bow with the feet and draws the cord with both hands; the arrows, of which the priest had collected a number, are seven or eight feet long and made of wild cane or *chuchilla*. Apparently the Sirionós are unacquainted with the use of poison.

Probably the Guarayos suffer more at the hands of the Sirionós than the Yuracarés, because the former two tribes come in contact more frequently. Padre Wolfgang, in charge of one of the missions of Santa Cruz de la Sierra, was on one occasion attacked and several of his men were captured; a few



FIG. 6.



FIG. 7.

FIG. 6—A Yuracaré dwelling.

FIG. 7—A corner of the Franciscan mission on the Chimoré.

days later he found them nailed to trees with numerous long thorns. On another occasion he surprised a party of Sirionós and succeeded in capturing seven; these he took back to the mission, but they proved to be intractable. He found it necessary to tie them to posts in order to prevent them from escaping; they steadily refused food and water, and after a few days four sullenly died of starvation. The priest took pity on the remaining three and released them.

After five pleasant days on the Chimoré crowded with interesting and unusual experiences, we returned to the mission and spent a few days there packing the valuable zoölogical collections. We then set out to go back to our base on the Chaparé, deciding to proceed by way of the Coni, a small stream emptying into the Chaparé, a few miles above Todos Santos. We followed a path through the forest for a distance of three miles, arriving at a large clearing which was planted in sugar cane. We were greatly surprised to find that the owner was a Quechua, who had deserted his home in one of the high valleys near Cuchicancha and had come to live in the hot tropics. He had constructed a crude wooden mill for expressing the juice from the cane stalks, erected a still, and was making alcohol. We had gone to the mission with the intention of remaining a week, and with many misgivings as to the outcome of our visit; but the good missionary had proved to be a most kind-hearted and generous man, and more than three weeks had flown by before the many imperative duties ahead forced us to return reluctantly to the port.

Padre Fulgencio walked to the Coni with us and supplied men and canoes for the six hours' journey to Todos Santos. His regret at our departure was as genuine as our own, and I look forward with pleasure to another and longer visit to the mission and the boundless country of the upper Chimoré.

THE PEOPLES OF HUNGARY: THEIR WORK ON THE LAND

By B. C. WALLIS

Hungary is the western outpost of the Eurasian steppe. The great plain of Hungary, the Alföld, is the heart of the country, physically, nationally, and economically.

Physically, the Alföld is almost rectangular and lies between the meridian of Nagyvárad (Grosswardein) and the Danube and between the Serbian boundary and the latitude of Vác (Waitzen). The plain is the work of depositing streams; on the edges the rubble contains fragments of granite, basalt, quartz, and chalk; towards the middle sand and clay form a sheet of alluvium which sometimes exceeds four hundred feet in thickness. Once an Alpine sea, the originally salt waters gradually changed from brackish to fresh. Relics of the former basins are to be found in the numerous shallow lagoons, reed-filled and margined with willow shrubs, some of which dry up during the intense heat of midsummer, and in the deposits of salt and saltpeter.

To the west lie other lowlands, which, however, lack the size and the unity of the Alföld. Immediately adjoining the Danube the lowland is in general a deposit of loess, but the plain is broken by ranges of small hills. Farther to the west, between Lake Balaton and the frontier and stretching northwards across the Danube, is the Little Alföld. Slavonia is a riverine lowland, and Croatia gradually increases in height to a maximum in the Alpine Karst. East of the Alföld lies the mountainous country of Transylvania. The Bihar Mountains are separated from the Carpathians by the lower hill country of the upper Maros and upper Szamos valleys. Outside the whole, along more than half of the frontier, from the Danube at Pozsony (Pressburg) to the Danube near the Iron Gate, lie the Carpathians (Fig. 1).

The Alföld itself contains country of three types. Arid sandy districts occur in Cumania between the Danube and the Tisza (Theiss), and in Nyír, south of the great curve of the Tisza to the northeast of Debreczen. Cumania has few streams; its marshes and lagoons mark the limits of the flood areas of the two main rivers. Towards the middle of the district the land rises higher than 300 feet above sea level, and usually it is at least 60 feet above river level. Long lines of sand dunes stretch across country, and between them the hollows are frequently water-logged. Nyír is even a more desolate waste. It was once covered with trees (*nyír*=birch) and subsequently became treeless like the true steppe; but both there and in Cumania plantations of acacia check to some degree the shifting sand. This is the poorest area of the Alföld.

Flatter and lower-lying country, covered here and there with a ten-foot layer of black earth or humus, lies east of the Tisza, between Debreczen and

the Maros. Here the sky line is unbroken, like that of the sea, and across this apparently level land the Berettyó and the threefold Körös (White, Black, and Swift), coming down from the Bihar Mountains, flow sluggishly to the Tisza. Here are hundreds of tiny rounded humps, varying from ten to thirty feet in height, which serve as house sites in the extensive tracts which are subject to the disastrous floods of the Tisza. The flood areas are gradually being reclaimed from the annual inundations (Fig. 2).

Finally, there is the southern Alföld, less extensively flooded, lying between the Danube, the Tisza, and the Maros. In the southwest for forty miles, with an average breadth of ten miles, stretches a desert, probably the largest area of true sand desert in Europe.

The Alföld is by nature treeless, a true grass steppe: it is semi-desert, with an extreme climate, swept by whirlwinds of sand in summer and of snow in winter. Man has planted trees to restrain the sand, raised dams and embankments to contain the spreading waters, and sunk wells to obtain supplies of potable water for man and beast, but his main work is yet to do, for the trees are not sufficiently numerous, many embankments lack height, and the wells are of a primitive simplicity. Frequently a forked tree trunk is the fulcrum of a lever consisting of a second trunk from the tapering end of which hangs the water bucket. The Danube floods spill over into the lower Tisza and hold up the waters of that river just when the Tisza and its tributaries are fullest from the melted snows of the mountains. The inundations spread over large areas, and few towns have arisen close to the river bank. Szeged, for example, has been frequently damaged and was practically destroyed in 1879. The regulation of the river waters has taken the double form of erecting embankments and of straightening the rivers (Fig. 2).

The periphery of the plain includes five areas: Transylvania, the narrow Carpathian rim to the northeast, the High Tátra and the neighboring mountains to the north and northwest, the western lowlands between the Danube and the Drave, and the mesopotamian lowland of Croatia-Slavonia. Transylvania is deeply notched by its rivers, and the inhabitants congregate in towns and villages on the alluvial flats of the valleys, which are the chief highways of communication. Usually it is quicker to travel by train down one valley to the railway junction on the Alföld and travel up a second valley than to attempt a journey across the hills or mountains. A typical town site is on the edge of a flat close against the line where the mountain slopes begin sharply to rise to at least a quarter of a mile above river level. The Bihar Mountains on the west and the Carpathians on the east are of Archean origin, but the lower hill country of the river valleys between them is almost entirely Tertiary.

In the northeast occurs the narrowest and lowest part of the Carpathians, between Ungvar and Przemyśl. The Hungarian slopes are Archean, with Tertiary sandstones lying to the north towards Galicia. Primeval forests of firs clothe the lower hillsides and give rise to a timber industry which

makes use of artificial flumes and mountain torrents to float the logs to the Tisza, which is a highway for numberless timber rafts.

The northern mountains culminate in the High Tátra, a tourist center of great beauty, where bare mountain tops throw shadows over mountain lakes and tarns, gems of scenery. The river trenches here are more acute than those of Transylvania, and here, as in the southeast, the towns on the valley floor are tucked against the steep slopes. Only the mining centers (*bánya*—

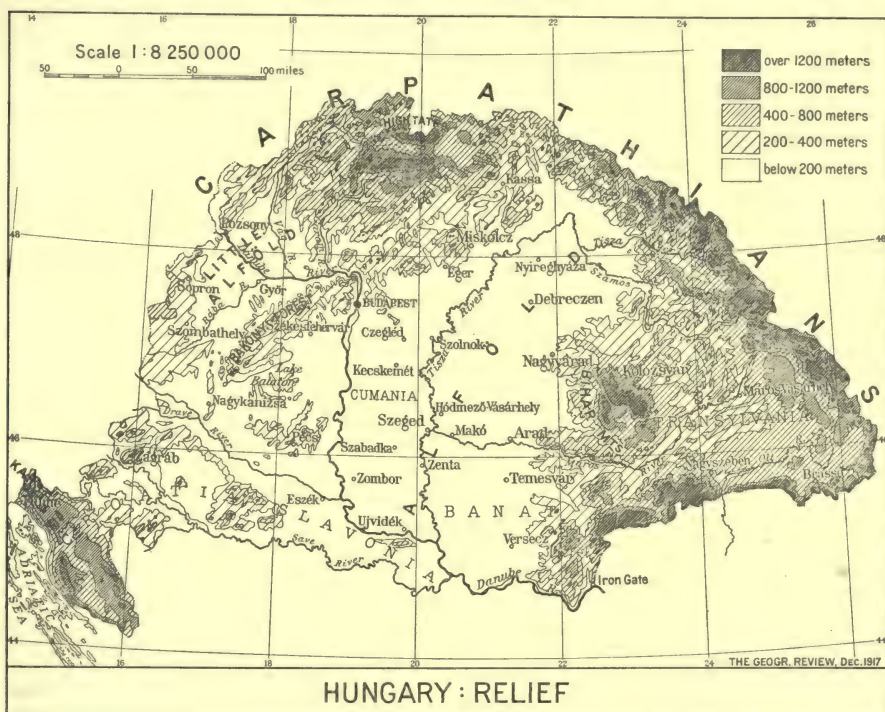


FIG. 1.

mine) lie in cuplike hollows between the hills (Selmeczbánya, Schemnitz). In the extreme west, between the mountains and the river, lies the northern half of the Little Alföld. The mountains provide timber from the lower slopes, and the ores, especially of iron, in the valley of the Garam (Gran) give rise to the name Hungarian Ore Mountains as a substitute for the local name, the Fáttra, for the heights which lie across the valley of the Vág (Waag) from the High Tátra.

Across the Danube the Little Alföld extends southwards to the ridge of high ground (Bakony Forest) which forms the southern watershed of the Rába (Raab) and runs along the northern shores of Lake Balaton. Farther south the lowland is crossed by ridges, and the whole area between the Danube and the Drave is intersected by the outliers of the Austrian and Styrian Alps. Many of the hills are clothed with beech trees, for instance

the Bakony Forest. Finally, near Pozsega and Pétervárad, in the mesopotamian region, there are low hills which accentuate the watershed between the Drave and the Save.

HUNGARIAN ADMINISTRATIVE DIVISIONS

Before passing to the consideration of the distribution of the people of Hungary, it is necessary to deal with the local government divisions of the

country. For purposes of administration Hungary is composed of counties and certain towns which are independent of the county organization. The counties comprise districts and a second class of towns. The counties and both classes of towns are shown on the map (Fig. 5). The districts are made up of parishes.

The county boundaries are related in numerous cases to the relief and drainage. Large stretches of the Danube, the Tisza, the Maros, the Drave, and the Save

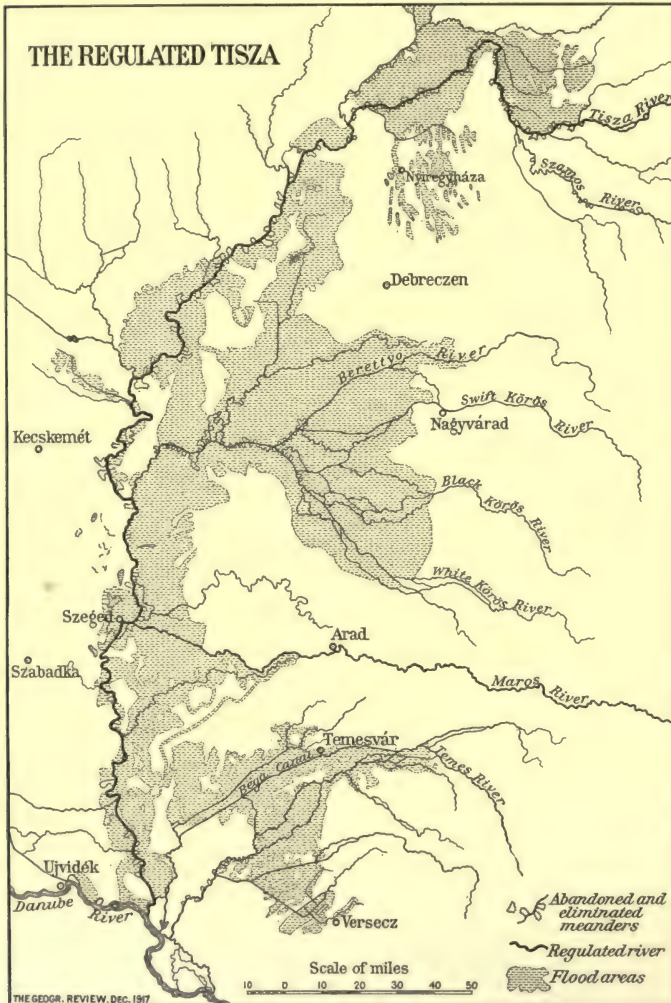


FIG. 2—Scale, 1:3,300,000.

boundaries, e. g. Szabolcs, Bács-Bodrog. Some counties, such as Turóc, are practically an intermontane lowland; in others, such as Kolozs and Liptó, the mountains serve as part of the boundary. Both classes of towns vary considerably in size; Debreczen, Szabadka, etc., on the Alföld, are as

large as the smaller counties. Among the hills the towns tend to be limited in area and to resemble the towns of other countries.

The extent of the areas administered by the urban authorities of the plain is susceptible of an historical explanation. When the Turks overran Hungary they murdered or carried off into slavery the people who lived in small villages or on remote and lonely farms. When the land was finally freed from the Turk large areas were devoid of inhabitants and only the larger towns had survived. Land was therefore easily acquired by the urban authorities. The towns of the Alföld are based upon the land and its products. Owing to the entire absence, locally, of road metal, dirt roads lead into the towns from the plain. These roads cross at right angles, and at the nodal point of the most important crossing a wide, open space lends itself to use either for a fair or a market. Alongside the roads are the detached houses built rectangularly round a central yard on to which the doors of the dwelling house and the outhouses open across a veranda. The house is usually of one story and frequently occupies two sides of the rectangle. In the middle of the yard is the well. In a primitive fashion such towns suggest the ideal town plan of the ardent advocate of the City Beautiful.

In the accompanying maps the basis used for the presentation of the facts varies. Inasmuch as it is essential that the facts regarding the Hungarian peoples should be determined with the greatest possible accuracy, Figures 3 and 4 are based upon the parishes and the towns. Since the same detailed accuracy is not requisite for the agricultural facts, Figures 6, 7, and 8 are based upon the counties and the towns of the first class.

THE DISTRIBUTION OF THE PEOPLE

Since the lines upon Figure 3 have been drawn by the method of contours, it may not prove too great a strain to ask the reader to visualize that map as if it were a presentation of the relief of the land. Such a survey gives the impression of two levels of lowland, dotted with numerous peaks, either clustered upon a broad-based mass or extended along ridge lines. The real lowlands lie along the southeastern, eastern, and northeastern boundary. From this lowland almost everywhere a sharp change of level leads to numerous peaks situated along a ridge line which bends in sympathy with the Hungarian boundary. Within this curved ridge lies to the west a plateau, which drops in Kolozs, Cumania, and Slavonia to the lower levels. Above the plateau two lines of heights stretch from Pozsony and Zágráb (Agram) respectively to meet in an acute angle at Nagyvárád. In addition there are scattered peaks, some of them of considerable elevation.

This survey of the distribution of the population may now be related to the actual relief of the country. The relationship is usually inverse. The plateau with its lines of heights is the Alföld and the corresponding lowland farther west. The lowest levels of the people correspond to the Carpathians, the Bihar Mountains, and the Karst. The curved ridge line of the eastern

people is related to the hilly country of the Számos and the Maros. Only in Cumania and in the mesopotamian country do the actual physical lowlands correspond to the low levels of the population.

Figure 3 may be compared with Figures 5 and 6 in the article "Central England During the Nineteenth Century" in the *Geographical Review* for January, 1917. Hungary as a whole is similar to the rural parts of Central England, where the population on the hills falls below 50 per square kilometer, and that of the lowlands lies between 50 and 100 inhabitants to the same area.

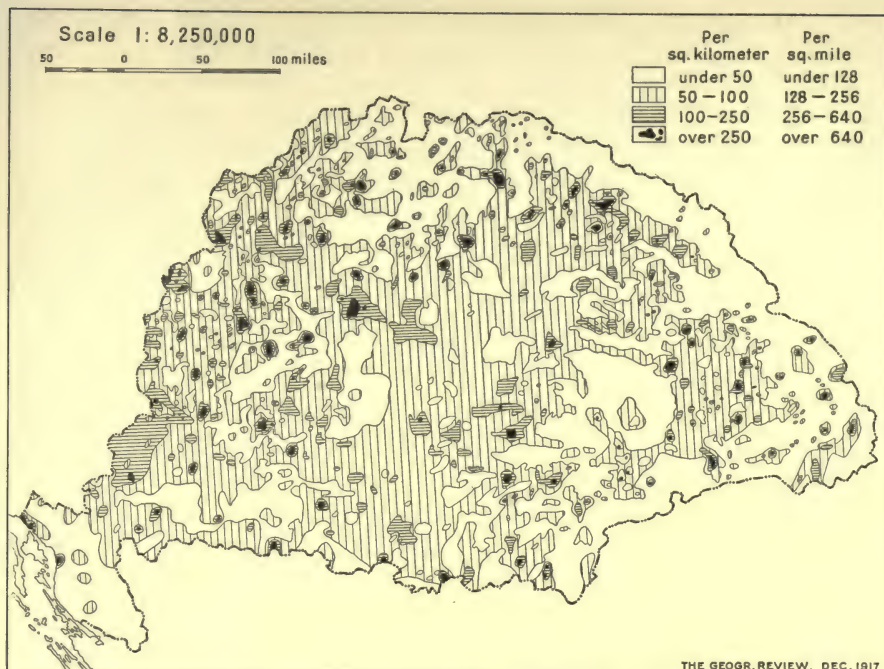
THE DISTRIBUTION OF THE NATIONALITIES

The survey of Figure 3 which has just been completed naturally leads to the consideration of Figure 4 from the point of view to which the geographer is accustomed when he examines a geological map. The lowest population levels along the eastern boundary occur with outcrops of Rumanians, Magyars, Rumanians, Ruthenians, and Slovaks in that order beginning in the south. There are also occasional outcrops of Germans.

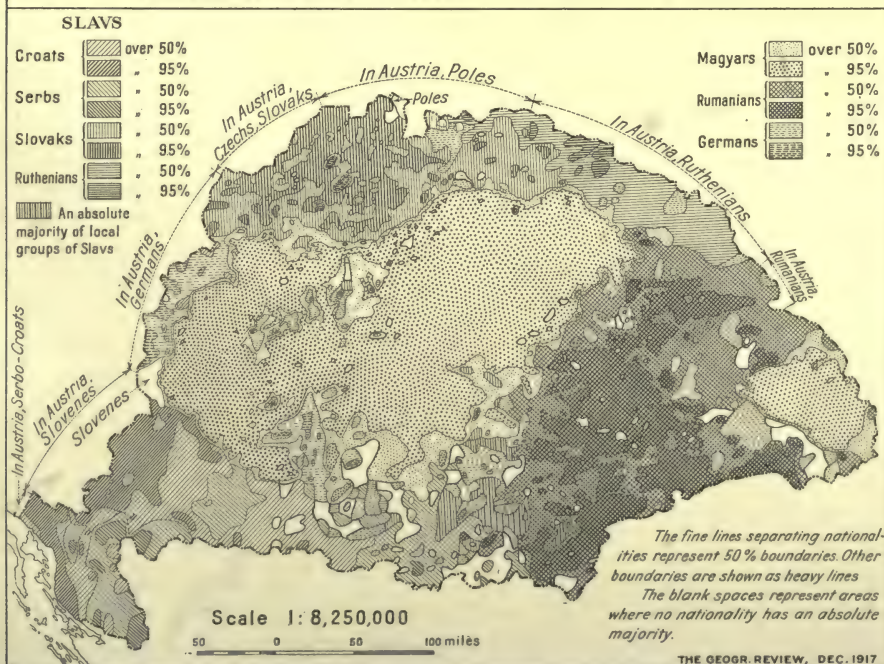
The eastern ridge line is mainly Rumanian, with obtruded areas of Magyars or Germans. The lower population level of the Bihar Mountains is wholly Rumanian, that of Cumania is entirely Magyar.

The plateau of population is almost completely Magyar; its northern edge marks the change from Magyar to Slovak, while the southern edge from Nagyvárád as far as the Maros is coincident with the change from Magyar to Rumanian. This latter ridge line is crossed in its western continuation to the Danube by intrusions of Germans, while beyond the river it is wholly Croat. Slavonia is a population lowland of either Croats or Serbs. Along the western boundary between Zággráb and Pozsony the larger areas of highland are Croat in the south, Slovene next, and German in the north. The smaller scattered heights immediately to the east are definitely Magyar. A large intrusion of Germans, which is not closely related to the population levels, occurs to the northwest of Lake Balaton.

These facts may be summarized in the more usual manner. The Alföld and other lowlands are peopled to a medium density almost entirely with Magyars. The exceptions are the Slovaks of the Little Alföld north of the Danube, the Slavs of the mesopotamian area, and the Germans near Lake Balaton and in Baranya County. The Bihar Mountains and the southern Carpathians are thinly peopled with Rumanians. Ruthenians provide a sparse population for the northeastern Carpathians. The southeastern Carpathians are thinly peopled by Rumanians in the north and by Magyars in the south. The eastern edge of the Alföld is a narrow debatable land into which Germans and Serbs have intruded. North of the Drave and the Danube from Pécs to Panesova is a comparatively densely peopled lowland, where Magyars, Germans, Serbs, and Croats usually live, separated from one another, in single or isolated groups of parishes. The areas of densest



HUNGARY : POPULATION DENSITY IN 1910



HUNGARY : DISTRIBUTION OF NATIONALITIES IN 1910

FIGS. 3 AND 4.

rural population are the Croat areas near Zággráb and the intrusions of Germans across the frontier from Germanic Austria.

Several facts of prime importance emerge from a consideration of Figure 4. First, the political boundary of Hungary frequently coincides with a sharply defined separation between two races, e. g. Slovenes and Croats in the southwest, Germans and Slovaks north of the Danube in the northwest, Poles and Slovaks in the north, Rumanians and Magyars in the southeast. Clean-cut separation of this nature agrees in character with the racial separation which occurs in Austria rather than with that which occurs within Hungary. The Austrian Germans are sharply separated from the Italians in the southwest, the Slovenes in the southeast and the Slavs in the north. In Hungary so precise a delimitation occurs only along the Drave, where the 95 per cent lines of Croats and Magyars practically coincide with the river itself. Secondly, the heart of Hungary is a comparatively dense population of Magyars upon the Alföld. Practically everywhere the upland or mountain regions are peopled by other races. In the third place the racial line of separation between Slovaks and Ruthenians tends to coincide with the transverse division between the High Tátra and the eastern Beskids. Fourthly, the Alföld, south of the line of the Maros, is not Magyar but contains Serbs, Germans, and a few Rumanians. Finally, in the mesopotamian area there is no definite line of demarcation between Croats and Serbs.

THE ACCURACY OF THE HUNGARIAN CENSUS

Figures 3 and 4 are based upon the information published in the Hungarian census report for 1910, yet it is no exaggeration to say that Figure 4 would serve equally well to show the distribution of the nationalities in 1881. The importance of this fact will become evident from what follows.

It is customary for German advocates of the expansion of *Deutschtum* and for Yugo-Slav (i. e. Southern Slav) propagandists to assert that the Hungarian census is inaccurate; *prima facie* this plea is justified on the ground that the census officials are Magyars and that Magyars are likely deliberately to falsify the returns. This suggestion gains color from the naive enthusiasm with which the Magyars acclaim even the slightest apparent increase in the number of Magyars and extol the progressive peaceful Magyarization of the country. The proportion of Magyars has undoubtedly steadily and slightly increased, but Figure 4 shows conclusively that the Magyar area has practically remained constant. The apparent contradiction involved in this statement disappears in the light of the following circumstances.

Between 1880 and 1910 the census returns became more accurate; in 1880 usually about 5 per cent of the people were returned under the heading miscellaneous; in 1910 this heading included but 2 per cent. There is distinct evidence in the case of all nationalities of a tendency for a dominant

race to increase its predominant proportion, e. g. to increase from 74 per cent in 1880 to 78 per cent in 1910. This tendency merely brings the lines marking the racial boundaries a little closer, but on a small-scale map it is impossible in many cases to show the lines representing 95, 75, and 50 per cent of a nationality without exaggerating the distance between them. The Magyar claims to a successful spread of Magyar culture are based upon the cumulative records for, sometimes, the whole country, and, at others, for the counties; but the nationality lines, such as those shown in Figure 4, rarely coincide with administrative boundaries. Consequently nothing but a detailed examination of the records for the seven thousand-odd parishes of Hungary will prove adequate to the demonstration of the facts regarding the races of the country; and it is believed that Figure 4 is the first published attempt to show the details regarding the nationalities in this manner.

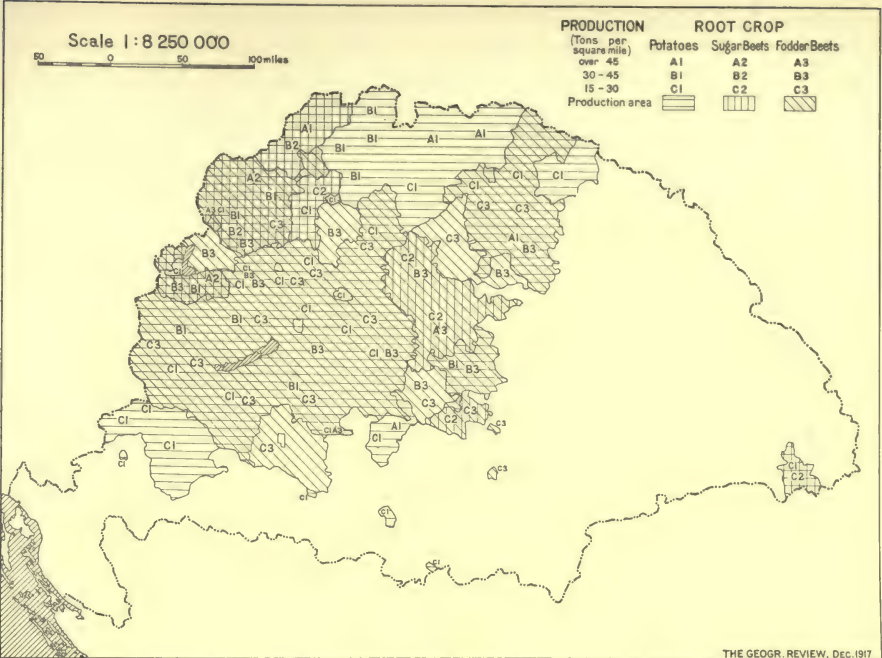
It may also be noted in connection with the Yugo-Slav claims, which usually refer to the counties of Bács-Bodrog (the Bačka) and Torontál and Temes (the western portion of the Banat), that the Serbs and Germans are the chief peoples of these areas; hence, if the Magyar official deliberately falsified the returns, he could not, as regards this particular area, advance Magyar claims by such action.

The situation may be summed in the conclusion that the census of 1910 is as accurate as censuses usually are, or is as inaccurate as that for 1880 and inaccurate consistently for the same parishes. This alternative implies that the falsification, if it has taken place, has been consistent for a generation; and this implies a deliberate plan pre-arranged before the census of 1880. Finally, it is important not to lose sight of the results of two factors, each of which tends to account for the relative gain of the Magyars and the relative loss, for example, of the Slovaks. These factors are the natural increase of the population and emigration from Hungary, chiefly to America. The different races do not multiply at the same rate; it is possibly a Magyar fiction that Magyars are the most fertile race. It is also likely that the Magyars emigrate in the smallest numbers. Without a detailed statistical examination of the influence of these two factors, an examination which is beyond the immediate scope of this article, it is not possible to be dogmatic upon their effect; it will suffice merely to indicate that their action becomes exaggerated in comparing the constitution of 100 average Hungarians in 1880 with their constitution in 1910.

The net result of all these considerations is that the census returns must be taken as accurate.

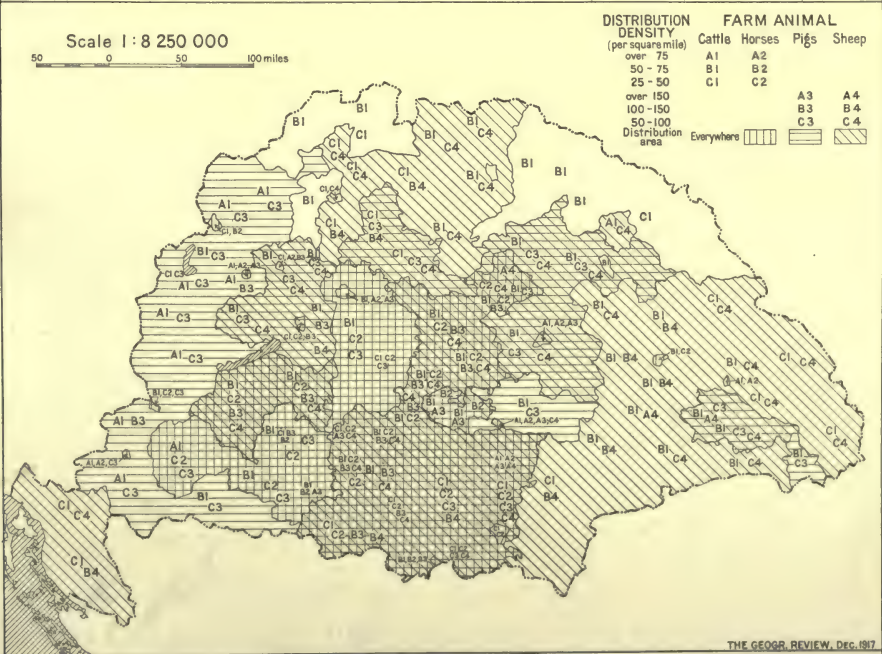
HUNGARIAN AGRICULTURE

Nearly three-quarters of the people of Hungary derive their living from the land. Hence an examination of the farm produce of the country is the most important guide to an estimate of the relative value of the Magyar plains, the Slovak and Rumanian hills, and the German and Yugo-Slav lowlands.



THE GEOGR. REVIEW, DEC. 1917

HUNGARY : PRODUCTION OF ROOT CROPS IN 1900



THE GEOGR. REVIEW, DEC. 1917

HUNGARY : DISTRIBUTION OF FARM ANIMALS IN 1910

FIGS. 7 AND 8.

Figure 6 is based upon the records for 1900 of the cereal yield of the Hungarian counties. Cereals are largely grown only on the Alföld and the western lowlands. Two areas of great importance may be distinguished. In the Alföld north of the Maros to the latitude of Debreczen and east of the Tisza is the chief cereal area, notable for its wheat and maize. Bács-Bodrog County comes second, with wheat, maize, and oats. By contrast Cumania has only moderate crops of maize. Next in importance, the Little Alföld north of the Danube yields maize and is the chief area for large crops of barley. On the other lowlands the chief crop is maize, accompanied at times by relatively small yields of wheat. Barley is the only cereal which is practically entirely produced by one race, in this case by the Slovaks; this barley region is the eastward extension of a more important barley region in the neighboring parts of Austria. Maize is the common crop in the hilly districts, and both the maize and the wheat areas are connected with the great areas devoted to these cereals in Rumania and South Russia.

The Hungarian counties are comparable in area with the counties of Great Britain, and those counties which are marked B on the map (Fig. 6) in the case of wheat are equivalent as regards wheat production to the most productive English counties, Cambridgeshire and Lincoln. The wheat yield of Hungarian wheat areas exceeds both in acreage and in production that of England's best wheat region and is at least as great as that of the best wheat areas in northeastern France. On the other hand the yield of oats cannot compare with the production of Britain's best oat areas.

Figure 7 indicates in similar fashion the distribution of the chief Hungarian root crops in 1900. Except in northwestern Croatia roots are grown by Magyars, Germans, and Slovaks, usually upon the lowlands, but also among the hills where the Slovaks live. The production of sugar beets is almost confined to the Slovaks of the Little Alföld and the Germans of the county of Sopron, where potatoes and fodder beets are also largely grown. Some sugar beets as well as fodder beets are grown by Magyars in the northern portion of the Alföld wheat area. The Slovaks of the northern mountains are great growers of potatoes; this crop is not grown east of the Tisza, but the Magyars and Germans west of that river grow potatoes and fodder beets. In the case of both sugar beets and potatoes the Hungarian areas of extensive production are adjacent to areas of great production in countries across the Hungarian borders.

In Britain many counties have a potato crop which exceeds 100 tons per square mile, so that, judged by British standards, the Hungarian is not a great producer of root crops.

The distribution of farm animals in Hungary for 1910 is shown in Figure 8. Cattle are raised everywhere, but by far the best area is the country along the Austrian boundary from the northern mountains to the edge of the Karst, where Slovaks, Germans, Magyars, and Croats raise

cattle almost equally well. Among the mountains cattle are the chief farm animals of the mountain Slovaks and the Ruthenians.

The Rumanians raise sheep as well as cattle, and some pigs are raised, chiefly by Germans, among the southeastern hills. As a rule, the cereal areas, Magyar north of the Maros, and German and Serb south of that river, contain large numbers of all kinds of farm animals, and these two areas are practically of equal importance in this respect. The Magyar lowland, west of the Danube (Tolna and Somogy Counties), also ranks well as regards animals. Cumania and practically the whole country south and west of the Danube lacks sheep. There are few horses outside the Alföld.

These farm animals are not raised upon English or American lines, although distinct efforts have been made to establish pure strains and to introduce pedigree animals from other countries to improve the local stocks. Both among the Slovaks and the Rumanians sheep are frequently milked, and there is an important production of sheep-cheese. Judged by English standards, the cattle and sheep of Hungary are not numerous.

The maps, Figures 6 to 8, represent the facts in proportion to the total area of each county, irrespective of the circumstance that the county may contain hill and dale, mountain pastures and arable alluvial flats. Such a method of presentation gives a perspective view of the country which has its limitations, and it is advisable to correct the vision by means of a second method of presentation. For this purpose the accompanying tables have been prepared upon a basis which indicates for each county the fraction of the total crop, or of the total number of animals, for Hungary as a whole. The numbers are thousandths of the total yield in each case.

TABLE I—AGRICULTURAL PRODUCTION OF HUNGARY BY REGIONS
(The numbers denote thousandths of the total Hungarian production)

(a) *Central Alföld near the Tisza*

COUNTY	CEREALS					ROOTS			ANIMALS				AREA IN 100 Sq. Km.	POPULATION DENSITY PER Sq. Km.
	WHEAT	RYE	BARLEY	OATS	MAIZE	POTA- TOES	SUGAR BEETS	FODDER BEETS	CATTLE	HORSES	PIGS	SHEEP		
Heves	18	10	16	7	15	7	31	30	9	14	12	14	37	64
J.-N. Szolnok ..	45	8	34	15	36	5	34	55	14	23	19	14	36	66
Békés	35	3	36	18	24	3	16	35	11	22	26	10	35	79
Csongrád	11	11	13	7	9	4	7	13	6	10	12	6	16	71
Csanád	16	2	13	8	16	1	18	10	5	14	13	2	14	76
Hód-Vasárhely ..	8	..	5	1	6	1	..	5	2	7	9	2	8	82
Total	133	34	117	56	106	21	106	148	47	90	91	48	146	73

(b) *Alföld between the Tisza and the Danube*

P.-P.-S.-Kiskun	31	138	51	30	60	45	25	77	28	46	39	21	103	80
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(c) *Southwestern Lowlands*

Somogy	29	50	31	25	30	36	34	50	26	30	42	29	67	51
Tolna	22	19	23	15	23	25	14	19	13	17	22	13	35	73
Baranya	25	15	15	22	23	16	4	32	17	26	25	11	51	59
Total	76	84	69	62	76	77	52	101	56	73	89	53	153	61

Table I summarizes the results achieved in the best agricultural region, that east of the Tisza. This, an area slightly less than 5 per cent of the total area of Hungary, has an average production of oats, cattle, and sheep, a small production of rye and potatoes, and a high yield of the other farm products, especially wheat and beets. West of the Danube an equivalent area produces smaller quantities of the cereals, with the exception of rye; of roots, except potatoes; and, on the whole, a smaller number of animals. By contrast the Alföld between the Tisza and the Danube has a poor yield in every case but one—rye.

TABLE II—AGRICULTURAL PRODUCTION OF HUNGARY BY REGIONS
(The numbers denote thousandths of the total Hungarian production)
(a) *Little Alföld north of the Danube*

COUNTY	CEREALS					ROOTS			ANIMALS				AREA IN 100 SQ. KM.	POPULATION DENSITY PER SQ. KM.
	WHEAT	RYE	BARLEY	OATS	MAIZE	POTA- TOES	SUGAR BEETS	FODDER BEETS	CATTLE	HORSES	PIGS	SHEEP		
Nyitra.....	12	41	78	15	14	43	218	32	22	15	15	8	53	78
Pozsony.....	13	28	56	8	21	36	83	34	17	11	12	2	41	68
Total.....	25	69	134	23	35	79	301	66	39	26	27	10	94	73

(b) *Little Alföld south of the Danube*

Moson.....	7	12	22	4	18	5	16	21	7	7	5	..	20	47
Sopron.....	14	25	28	11	15	22	120	25	16	8	13	5	31	80
Győr.....	6	12	9	5	13	8	12	12	6	5	9	3	15	62
Komárom.....	10	14	18	11	13	17	15	16	8	10	11	8	28	64
Total.....	37	63	77	31	59	52	160	74	37	30	38	16	94	63

Table II presents the results for two portions of the Little Alföld, each of which contains roughly 3 per cent of Hungary. The northern area has a high production of barley and roots but yields less maize. With the exception of cattle neither of these areas contains proportionately so many animals as any one of the areas in Table I, but each has a relatively higher production of roots. In the case of cereals these northwestern areas occupy an intermediate position between the two portions of the Alföld which are separated by the Tisza.

TABLE III—AGRICULTURAL PRODUCTION OF HUNGARY BY REGIONS
(The numbers denote thousandths of the total Hungarian production)
Southern Counties

COUNTY	CEREALS					ROOTS			ANIMALS				AREA IN 100 SQ. KM.	POPULATION DENSITY PER SQ. KM.
	WHEAT	RYE	BARLEY	OATS	MAIZE	POTA- TOES	SUGAR BEETS	FODDER BEETS	CATTLE	HORSES	PIGS	SHEEP		
Bács-Bodrog...	70	6	23	106	79	15	..	15	25	51	50	26	85	71
Torontál.....	9	5	20	39	78	11	7	24	25	73	40	47	95	58
Temes.....	48	6	9	25	38	6	1	12	17	42	25	28	72	54
Total.....	127	17	52	170	195	32	8	51	67	166	115	101	252	61
K-Szőrénny.....	17	3	2	15	24	6	..	1	23	17	19	6	109	40
Cr-Slavonia...	79	63	57	76	90	98	9	11	153	146	151	100	420	63

Table III contains the particulars relative to the area claimed by the Yugo-Slavs., i. e. Bács-Bodrog and the western Banat, the eastern Banat (Krassó-Szöreny), which is Rumanian, and Croatia-Slavonia, which is entirely Slav. Krassó-Szöreny does best in animals, but even in these is below the average. Croatia-Slavonia is more productive, on similar lines, than Krassó-Szöreny, but only attains an average yield in the case of animals. The southern Alföld is productive of wheat, oats, and maize, and of all the animals except cattle.

Excluding Krassó-Szöreny and Croatia-Slavonia, which are of minor importance, the total area of the counties included in these tables exceeds but slightly one-fourth of the total area of Hungary, while the yield of the various products ranges from 30 to 60 per cent of the Hungarian output. On the whole the results achieved by each method of survey lead to the same conclusions. Table I shows variations in products on purely Magyar lands and exemplifies the influence of soil. Table II contrasts Slovaks with Magyars, while the high productivity of the county of Sopron is to be associated with a large admixture of Germans. Table III provides a contrast between the purely Slav lands south of the Danube and the lands with Slavs and Germans together north of the river.

There are three areas of prime agricultural importance in Hungary. The first and most valuable is the Magyar area on the Alföld, which is notable for cereals, roots, and animals. This is the chief area of the Tisza inundations (Fig. 2), and the boundary line of greatest productivity tends to coincide with the limit of the Magyar folk near the foothills of Transylvania. A similar area of Magyar activity, but not of equally valuable achievements, lies north of the Drave and west of the Danube in Somogy, Tolna and Baranya Counties. The area of second importance includes Bács-Bodrog, Torontál, and Temes; this is an area without root crops, inhabited by many races, of which the most numerous are Serbs and Germans. The third area is the Slovak portion of the Little Alföld north of the Danube, the counties of Pozsony and Nyitra, notable for barley, sugar beets, and cattle.

The agriculture of Hungary is not independent; the country occupies an intermediate position between the cereal lands of southern Europe, with their extensive crops of maize and wheat, and the root and rye areas of northern Europe.

SLAV CLAIMS ON HUNGARY

Slav propagandists, relying upon the defeat of the Central Empires, have put forward claims to two portions of Hungary. These may be conveniently summarized under the terms "corridor" and "the Bačka." The corridor epitomizes the claim that the Northern Slavs, i. e. the Slovaks, Czechs, and Poles, should be united with the Yugo (Southern)-Slavs, the Serbs and Croats and the Slovenes, by means of a corridor of territory

which approximately includes the border lands between Austria and Hungary from the Danube to the Drave. The population of the Austrian portion of the corridor is entirely German. If but a small strip of Hungary be included, then again the people are chiefly German; if a wider piece be taken, then the extra width encroaches upon Magyar lands. These people are great farmers, maize, potatoes, and beets being extensively grown and cattle and pigs being raised in large numbers. From the point of view of the nationalities which inhabit the area there is nothing to be said in support of the Slav claim.

The term *Bačka* is used to cover all the country claimed by the Yugo-Slavs. This territory may be considered in three parts: Baranya, Bács-Bodrog, and the Banat (Torontál, Temes, and Krassó-Szöreny). The Yugo-Slav claim is pressed with reference to Bács-Bodrog and the western Banat, but is urged with less emphasis upon Baranya and with still less insistence regarding the eastern Banat. This grading of emphasis can be understood when we consider the nationalities of these areas. Krassó-Szöreny is definitely Rumanian. Baranya contains a few Slavs and many Germans and Magyars. The counties of Bács-Bodrog, Torontál, and Temes include areas which are definitely Serb or Slav, although some parishes are enumerated in the census as containing Shokatzes, Bunyevatzes, etc., i. e. under Slav names of local importance only. The other people are chiefly Germans. In this area, again, the Slav claims can only be satisfied at the expense of the Germans. The boundary of Greater Serbia would extend roughly along the present eastern boundary of Temes to the Maros, along the Maros westwards to the Danube, and either east of Baranya or across it to the Drave, and finally westwards along the Drave. The territory thus claimed from Hungary is occupied by relatively many people and is, probably, the second area of agricultural importance in Hungary. It extends on both sides of the Tisza and implies the Slav possession of the lower reaches of that river, as well as of the Danube below the Drave confluence. This latter fact is of prime importance in relation to the use of these rivers as navigable waterways from one part of Hungary to another.

CONCLUSION

The purpose of this paper is now served. No attempt is here made to do more than demonstrate the facts regarding the peoples, nationalities, and farm work of Hungary. Yet the exposition of these facts brings into prominence many examples of geographical control upon the life of man. It demonstrates conclusively that the Magyar is deep-rooted to the heart of Hungary, the central Alföld. The Slovaks more than any other of the nationalities betray a definite tendency towards the development of an economic life which essentially differs from that of the other races. This fact is, possibly, in part due to the mountains and plains of which their land is composed; yet it is in sharp contrast with the life of the Rumanians

in Transylvania, where the best farm work is usually performed by Germans or Magyars. This Slovak development has occurred in the face of direct opposition from the Magyar official caste. The work of the Slovaks is also of greater value than that of either Croat or Serb in the southwest.

The paper will have attained its object if it displays the outstanding circumstances in the present condition of Hungary, in due perspective, with adequate precision and without partisan bias.

A NOTE ON THE GUARANI INVASIONS OF THE INCA EMPIRE

By PHILIP AINSWORTH MEANS

In the *Geographical Review* for August, 1917, Baron Erland Nordenskiöld discusses the Guarani invasions of the Inca Empire.¹ The importance of his article, both from the anthropological and from the historical points of view, cannot be exaggerated. On one point brought up by Baron Nordenskiöld, however, each of two opinions can reasonably contain a measure of truth. One of these opinions is that held by Baron Nordenskiöld, who relies for support on Guzman, Cobo, Sarmiento de Gamboa, Cieza de Leon, Balboa, and Salcamayhua, to the effect that the Chiriguano, members of the great Guarani stock, did not enter the Inca Empire until they went there under the leadership of Alejo Garcia about 1522, late in the reign of Inca Huayna-Capac. There is, of course, but little doubt that the Guarani Chiriguano *did* enter the Inca Empire at that time and that Garcia was the first white invader of that empire. No one, I think, can disbelieve this in the face of the evidence presented by Baron Nordenskiöld. It is, however, possible to hold a different opinion from that entertained by him as to whether the invasion of Garcia in 1522 was the *first* invasion of the Inca Empire made by the Chiriguano. Baron Nordenskiöld mentions the important testimony of Garcilaso de la Vega only to throw it aside; he ignores the testimony of Montesinos altogether, as well as the modern research which has shown that both these writers ought to be peculiarly respected. Stated briefly, the situation is this: Both Garcilaso and Montesinos derived the major part of their information from Blas Valera, a son of Luis de Valera by a high-caste Inca woman. He was born in Chachapoyas, Peru, about 1540. From 1571 to 1594 he lived at Cuzco, Juli, and La Paz, studying the natives, their language, and their history. In 1594 he sailed from Callao to Cadiz, dying in the latter city about 1596.² The history of Garcilaso's life is too well known to require recapitulation here; suffice it to say that his opportunities for studying the native race of Peru were hardly less excellent than those of Blas Valera. Garcilaso acknowledges, many times, his indebtedness to Valera's history, which he saw at Cadiz. For a long time Valera's work was thought to have been lost in the sack of Cadiz by Essex in 1596. The researches of Gonzalez de la Rosa have proved that the "Relación anónima" brought out by Marcos Jimenez de la Espada in 1879 is part, at least, of Valera's work. This document is of an importance which cannot be over-rated, for it, like all

¹ Erland Nordenskiöld: The Guarani Invasion of the Inca Empire in the Sixteenth Century: An Historical Indian Migration, *Geogr. Rev.*, Vol. 4, 1917, pp. 103-121.

² See Clements Markham: The Incas of Peru, London, 1910, pp. 12-14.

Valera's writings and information, was derived from the most learned Indians at a time when the memory of the Inca period was still very vivid. On this man, of undisputed authority, both Garcilaso and Montesinos depended, the former frankly and the latter by plagiarism, for a large part of their knowledge.³

It is, therefore, difficult to find justification for Baron Nordenskiöld's course in flouting Garcilaso and ignoring Montesinos. Both historians, it is quite true, had faults in plenty, especially Montesinos. But nevertheless, because of their peculiar relations to Valera, their evidence in such a case as that now under discussion carries great weight.

What, then, is their evidence as to the date at which the Chiriguano began to invade the Inca Empire?

As Baron Nordenskiöld points out, Garcilaso speaks very definitely of a struggle which took place between the Chiriguano and the Incas in the reign of Inca Yupanqui.⁴ It is well known that the Inca historian confuses Pachacutec, Inca Yupanqui, and Tupac Yupanqui. In all probability "Inca Yupanqui" was really Tupac Yupanqui.⁵ The latter was certainly the successor of Pachacutec, and he reigned about the period 1480-1490. Garcilaso, therefore, gives us definitely to understand that there was hostile contact between the Chiriguano and the Incas as early as 1490 and that the latter, not the former, were the aggressors.

Montesinos is still more explicit. He says:⁶ "The army having been made ready, Huira Cocha ordered many officials to go ahead in order to open up a highway from Charcas to Chile by way of the Chiriguano, for there already was one from Cuzco to Charcas." In Chapter 24, while describing the conquest by the Inca of what is now Ecuador, Montesinos says: "For the sake of entire security, the Inca commanded that a fort be built while the troops for whom he had sent on account of their warlike nature were coming to him from Chile and from the Chiriguano." These two passages prove that Inca aggression had so far reduced the Chiriguano by the time that the conquest of Ecuador was undertaken that the Incas were enabled to call upon them to furnish auxiliaries. It should be noted in passing that the "Huiracocha" of Montesinos is partly the "Pachacutec" and partly the "Tupac Yupanqui" of other writers.

³ For the relations between Valera, Garcilaso, and Montesinos see Markham, *op. cit.*, p. 303ff.; various writings of Gonzalez de la Rosa, especially: El Padre Valera, *Revista Histórica de Lima*, Vol. 2, 1907, No. 2, and: Los Comentarios Reales son la réplica de Valera a Sarmiento, *ibid.*, Vol. 3, 1908, No. 3. Dr. Riva-Aguero tried, unsuccessfully, to question some of the conclusions reached by Dr. Gonzalez de la Rosa.

⁴ First Part of the Royal Commentaries of the Yncas (Markham's transl.), *Hakluyt Soc. Publs.*, 1st Series, Vols. 41 and 45, London, 1869 and 1871; reference in Vol. 45, p. 274.

⁵ Cf. P. A. Means: An Outline of the Culture-Sequence in the Andean Area, *Proc. Nineteenth Internat. Congr. of Americanists, held at Washington, December 27-31, 1915*, Washington, 1917, pp. 236-252; reference on p. 248. (This paper is reviewed below under "Geographical Publications.")

P. A. Means: A Survey of Ancient Peruvian Art, *Trans. Connecticut Acad. Arts and Sci.*, Vol. 21, 1917, pp. 315-442; reference on p. 387.

Clements Markham: The Incas of Peru, London, 1910, pp. 93-95.

⁶ "Memorias antiguas, historiales y políticas del Perú," Chs. 23 and 24. Quotations from Montesinos are taken from my translation, in the course of preparation for the Hakluyt Society.

Finally, Sarmiento de Gamboa, upon whom Baron Nordenskiöld rests his own opinion, says⁷ (as the Baron notes): "He [Huayna-Capac] went to Pocona to give orders on that frontier against the Chiriguanas, *and to repair a fortress which had been built by his father.*" The italics are mine. The italicized passage indicates clearly that, in Sarmiento's opinion, the father of Huayna-Capac (Tupac Yupanqui) had been in hostile contact with the Chiriguanos. All three of these writers, it will be noted, show that the aggression came from the Inca's side, not from that of the Chiriguanos. It is quite possible that the Chiriguano expedition of Alejo Garcia in 1522 was partly one of retaliation.

Before bringing this brief note to a close I should like to comment on one other point brought up by Baron Nordenskiöld. He says that the pre-Chiriguano people of the area in question were the Chané, who are Arawaks. It is very gratifying to me to have the support of so distinguished an authority as Baron Nordenskiöld for my tentative suggestion that the pre-Inca peoples of the Collao (i. e. the Titicaca Basin), the people who built up the great Tiahuanaco culture, were linked more or less closely with the great Arawak stock.⁸ The Arawak Chané spoken of by Baron Nordenskiöld lived not very far from the Collao, and their presence there lends considerable support to my belief.

⁷ History of the Incas (Markham's trans.), *Hakluyt Soc. Publs.*, 2nd Series, Vol. 22, 1907, p. 159.

⁸ P. A. Means: A Survey of Ancient Peruvian Art, p. 326.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Monthly Meeting of November. A regular monthly meeting of the American Geographical Society was held on Tuesday evening, November 20, at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. He submitted for confirmation the names of 406 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Mr. Donald B. MacMillan, leader of the Crocker Land Expedition, delivered a lecture entitled "In Search of New Arctic Lands." He first gave a general account of the expedition, the activities of which have been frequently reported in these pages (*Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 52-53 and 535; *Geogr. Rev.*, July, 1917, pp. 62-63, and October, 1917, pp. 320-321) and then dwelt more particularly on his various journeys during his four years in the Arctic. Among other things he reported the resurvey of the southeastern coast of Ellesmere Island and the discovery of several large glaciers, one of which he named the American Geographical Society Glacier. It is one of the major streams of ice by which the ice cap discharges into the sea. Mr. MacMillan's lecture was illustrated by excellent lantern slides and by motion pictures. The latter included a remarkable film showing the *Neptune*, the third relief ship of the expedition, pushing its way through the extraordinarily heavy ice of 1917.

NORTH AMERICA

Artificial Flood on the Ohio River as an Aid to Transportation. With the destructive floods of nature the Ohio Valley is unhappily too familiar: in August last was recorded a new kind. This was an artificial flood created to demonstrate the strategic use that might be made of the river even during the dry season, when it is normally closed to boats exceeding two feet in draught. The opening of dams on the upper waters produced a crest of three to six feet. On it were carried to Cincinnati 13,000 tons of coal, an amount that would have required 350 cars for rail transit (*Commerce Repts.*, Aug. 29, 1917).

Flood Control of the Miami River, Ohio. To prevent the recurrence of such disastrous floods as that of March 22-27, 1913, in Ohio, engineers have planned an elaborate system of control over the run-off in the drainage basin of the Miami River, one of the areas most disastrously affected (The Miami Valley Flood-Protection Work, *Engineering News*, Jan. 4, 1917, pp. 12-17; Jan. 11, pp. 62-65; Jan. 25, pp. 144-151; Feb. 1, pp. 186-188). A study of storm records has convinced them that combinations of meteorological conditions have rarely, if ever, been more unfavorable than on that occasion, and that there is no probability of greater floods in the future. As was pointed out by R. M. Brown (The Ohio River Floods of 1913, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 500-509), a heavy southwest storm followed close upon one from the northwest, both coming when the ground was already well saturated. An average of eight inches of rain fell in the Miami valley within five days. The consequent run-off was enormous. Plans at first were contemplated for channel improvement on a large scale, but the engineers soon became convinced that retarding basins would be the only means of securing absolute safety. The fan shape of the drainage basin tends to produce sudden floods that would be liable to overflow any levees constructed. Five large retarding basins are now being built in such a way that even the farm lands within their area may be utilized and will be in danger of flood only under exceptional conditions.

A Botanical Survey of British Columbia. In 1911 there was organized at Vancouver the Botanical Office of British Columbia. The work is under the direction of John Davidson, F.L.S. Three annual reports—for 1913, 1914, and 1915—have already been published. These describe botanical explorations in two regions hitherto even topographically not well known. The first and second reports (*First Annual Rept.*, pp. 17-21; *Second Annual Rept.*, pp. 50-74) deal with the Mt. Garibaldi region of the southern Coast Range. Mt. Garibaldi is a peak 8,700 feet high on the dividing crest between the Cheakamus and Lillooet Rivers and lies in about 49° 55' N. and 122° 50' W. The botanical work was carried out in connection with a trip by the British Columbia Mountaineering Club of Vancouver, whose president, Mr. W. J. Gray, made a very creditable survey of the region, a map of which on the scale of 1:50,000 accompanies an article by himself and H. Samson on "The Garibaldi Group" in a publication of the

club entitled "The Northern Cordilleran" (Vancouver, B. C., 1911, pp. 25-32) and reprinted in the *First Annual Report of the Botanical Office of British Columbia, 1913* (Victoria, B. C., 1914). The map embraces a stretch of territory some ten miles north of the peak and eight miles wide from east to west, including a hitherto unmapped alpine lake four miles long and 4,600 feet in elevation, named Garibaldi Lake. The botanical features noted exhibited the usual alpine habitus. Immediately below the tree line the slopes are often wooded, *Abies amabilis* (Forbes) and the mountain hemlock (*Tsuga mertensiana*) being the characteristic trees. With regard to the latter an interesting ecological observation was made. As a consequence of the continued browsing of mountain goats or sheep, the basal shoots of the trees of this species by repeated branching had formed an impenetrable thicket several feet in diameter around each tree until the center was beyond the reach of the animals; the central part then grows erect and is more or less normal.

The second region in which botanical observations were made is the eastern side of upper Skagit valley north of the United States boundary (see *Third Annual Rept.*). This trip also resulted in the correction of topographical details. All the principal creeks of the eastern side of the valley were ascended or descended, and the divide between the Skagit River (121° W.) and the South Similkameen River was found to lie farther east than supposed, at one point by as much as 8 miles.

Weather and the Amount of Cotton Ginned. An investigation of the relation of the weather to the amount of cotton ginned during certain periods has been carried out by J. B. Kincer of the Weather Bureau (*Monthly Weather Rev.*, Vol. 45, 1917, pp. 6-10). It appears that a forecast of the size of the cotton crop, based on the ginning reports, has a much greater value when consideration is given to the influencing weather factors than when the reports alone are considered. If temperatures during the critical months of growth are high and the weather is favorable for picking during the period covered by a given early ginning report (say Sept. 1-25), the percentage of the total crop ginned during the period may safely be considered as much in excess of the average, and the final yield less than that apparently indicated by the actual amount ginned to that date. Two weather factors, operating separately and independently of each other, largely control the relative amount of cotton ginned from year to year during a given ginning period, and also that ginned during the several periods of any single year. These factors are the temperature conditions during certain early months of the growing season (principally May-June) and the amount of fair or rainy weather during the ginning period itself. In studying early ginning reports, temperature has the controlling influence, but later, say for the period September 25-October 18, the amount of fair weather during the period itself takes precedence. The whole subject is one of great practical importance and illustrates the economic advantages which are to be derived from careful study of meteorological records. R. DEC. WARD.

Adaptation to Environment in Building the Cities of the Canal Zone. Describing the towns built by the American Government in the Canal Zone, Mr. Seymour Paul shows in a recent article (*American Cities in the Tropics, The South American*, September, 1917, pp. 14-15) how they have been adapted to the peculiar conditions prevailing there. Projecting roofs give shelter from rain and sun. Eaves gutters are not used because they would soon fill with leaves. Good drainage is important, even the sidewalks being constructed in the form of flat troughs to facilitate run-off. Low pillars raise the houses a few feet above the damp ground and provide more complete ventilation. Level building sites are avoided. The hill sides afford better drainage as well as freer air circulation. Screens are used on all doors, windows, and the wide porches characteristic of warm climates. Copper wire only can be employed in the screens. Interior fittings must be made of bronze or brass. Wood rots so rapidly that concrete buildings are more economical. Ants, too, destroy the woodwork, the hardest oak becoming honeycombed in a few years. A frame house will last only from ten to twenty years at best. Wooden structures withstand earthquake shocks well but concrete reinforced with steel has proved sufficiently pliable for the usually light "tremors" felt at Panama. The natural desire to build towns like those in the "States" has had to yield to the geographic environment.

SOUTH AMERICA

A New Theory of the Origin of the Chilean Nitrate Deposits. Few, if any other, surface deposits have given rise to so much discussion as the nitrate deposits of northern Chile. Because they are unique in extent and importance, their origin has interested scientists for three-quarters of a century. Many theories of origin have been

advanced, but none of them has been generally accepted. Several recent contributions to the discussion are noteworthy, because of the new aspects presented.

A paper by J. T. Singewald, Jr., and B. LeR. Miller (*Econ. Geology*, Vol. 11, 1916, pp. 103-114) has already been noticed (*Geogr. Rev.*, Vol. 2, 1916, pp. 465-466) but is here treated more extensively in order to do justice to the subsequent discussion it evoked. The paper points out that all the theories of origin depend on methods by which nitrates can be readily found, but not all the conditions postulated for such methods are supported by the facts from the Chilean fields. For purposes of discussion the various theories are grouped, according to sources and processes involved, under the four heads: seaweed theories, guano theories, bacterial theories, electrical theories. A brief consideration of arguments for and against the several ideas leads to the general conclusion that the evidence is insufficient to establish proof of the operation of any one of them. The authors then advance their idea that the deposits are the result of efflorescence from ground-water, the minute nitrate content of the underground water being accumulated as a result of evaporation.

The geography of the region is held largely responsible for the effectiveness of this process. Extreme aridity, strong insolation, barren surface, high water-table, and the loose, porous, detrital material composing the *pampa*, all combine to favor effective capillarity, active evaporation, and hence ready accumulation of soluble salts from ground-water. Since all underground waters carry some nitrate, "abnormal conditions of extreme aridity and shallow ground-water suffice to explain, in large measure at least, the unusual accumulations of nitrates that have taken place" in northern Chile. If the same conditions were duplicated elsewhere similar deposits would result.

The formation of nitrates is not peculiar to Chile, for they are being generated by well-known processes all over the surface of the earth. Northern Chile may be unique in the generation of nitrates in that more of the nitrate-forming processes have been active there than is generally the case. But, the authors contend, all the processes combined would be inadequate to account for the great amounts of nitrate, "if it were not for the all-important, remarkable conditions of climate, underground waters, and geologic structure existing in the region." The real problem, therefore, lies not in determining the mode of formation of the nitrates, but in explaining the conditions which have made possible their accumulation.

The localization of nitrate deposits in restricted areas along the western edge of the *pampa*, most commonly around the *salars*, is quite in keeping with the nature of the substance. If salt and nitrate were accumulated in the depressions, the nitrate would tend to creep out by efflorescence to the dry ground around the boundaries of the *salars*. This process would go on most actively where the ground-water comes nearest the surface, as it does toward the western edge of the *pampa*, and it would reach its maximum where a particularly porous area exists. Thus, "irrespective of how minute a quantity the original ground-water carries," this process, "long-continued, will lead to accumulations of large deposits of sodium nitrate."

Objections to this explanation of nitrate occurrences are raised by Lorenzo Sundt (discussion of Singewald and Miller's paper, *Econ. Geology*, Vol. 12, 1917, pp. 89-96) on the basis of long experience in the nitrate region. In Taltal, for example, topographic conditions are quite different from those in Tarapacá, where Singewald and Miller made their studies. Isolated ranges interrupt the slope from the Andes toward the coast mountains, in such a way that underground waters could not travel far. Nitrate deposits, however, are found on the slopes and even on the summits of isolated, flat-topped hills, where it would seem impossible for the supply to have any other origin than *in situ*, with the source of the nitrate in the atmosphere and the source of the soda in "decomposing feldspathic porphyrites." The absence of deposits in most of the width of the *pampa* is due to the absence of this porphyritic material. Sundt also states that the ground-water theory is inadequate because "there are extensive nitrate terranes in which wells eighty meters deep have not encountered ground-water."

In answer to Sundt's criticism, Singewald and Miller note that the absence of nitrate from many areas where feldspathic rocks are present is a serious weakness in any theory of origin based on that factor. Moreover, their original contribution was not to explain the mode of formation of sodium nitrate, but rather to account for the manner of the localization of the deposits. And the fact remains that the largest and most important deposits are related to ground-water in the manner called for by their theory. In those places where no such relation exists, diastrophic changes may have altered the ground-water level since the deposits were formed.

WALTER S. TOWER.

Vital Statistics of the Indians of Eastern Bolivia. A parish register is a somewhat unusual document to lay before a student of geography: it is from a source so unique that Baron Erland Nordenskiöld derives his interesting article "Die Bevölker-

ungsbeziehung unter den Indianern in Bolivien" (*Petermanns Mitt.*, April, 1917). During his expedition of 1913-14 Nordenskiöld visited the mission among the Mostenes at Covendo on the upper Rio Beni. From the priest's records, supplemented by verbal information, he has derived a series of vital statistics. To them have been added others from similar sources elsewhere in eastern Bolivia—recent figures from the Guarayos and Chiriguano missions (for location of these tribes see the map accompanying Baron Nordenskiöld's paper "The Guarani Invasion of the Inca Empire in the Sixteenth Century" in the August number of the *Review*) and the data gathered by d'Orbigny in his travels to the Mojos and Chiquitos missions in the earlier part of the last century. Fragmentary and imperfect as all these records must be, they nevertheless have a distinct value in showing the general demographic movement among the uncivilized tribes peopling a vast area.

Among these Bolivian Indians the birth-rate is high. In Covendo, for instance, between 1897 and 1912, when no epidemic occurred, the birth-rate was 83 per thousand. The average woman of the tribe bore eight children. Among the Guarayos (1912-15) it was 69 per thousand, a figure recorded by d'Orbigny for the Mojos and probably acceptable as an average. Twins are unusual and the number of children stillborn or deformed is very low. On the proportion between the sexes at birth it appears to be impossible to generalize, but among the majority of these tribes the men exceed the women. Probably the latter succumb more easily to the hardships of the savage life and possibly child-murder eliminates a greater proportion of the female sex. Marriage takes place at a very early age, and all mature Indians are married or have been married. The Indian quickly reaches old age: an individual old in years is unusual; the oldest Indian in Covendo was only 56 years old. Normally the death-rate is considerably inferior to the birth-rate. Infant mortality, of course, is very high. In the last two decades recorded in Covendo out of 240 children born 77 died during the first year. But it is the epidemics that cause the heaviest mortality, and smallpox transmitted by Indians from the plateau works the worst havoc. In 1886 it carried off over one-third of the population of Covendo, dealing them a blow from which they have never recovered.

The Uruguayan Meteorological Service. Much attention has been called to the valuable work accomplished by the Argentine Meteorological Office. Less conspicuous but very important have been the observations carried on in Uruguay. The latter country forms a distinct meteorological district, for its climate is modified by the wide estuary of the La Plata as well as by oceanic influence. It differs from the Brazilian coast in being farther removed from tropical conditions, and from Paraguay in the diminished continental character.

The Instituto Nacional Físico-Climatológico was founded in 1905. Its function is primarily climatological, as weather forecasting is done by the Instituto Nacional Meteorológico. Observations have been made for many years in the central observatory in Montevideo and other private institutions. The name of Luis Morandi, present director of the climatological institute, figures in most of the studies undertaken since 1888. The institute publishes a *Boletín Mensual*, now in its fifteenth year. Three hundred and forty-four stations report to it and railroads and packing companies co-operate. In each bulletin there is given an extract of the daily observations during the month. These afford a very good idea of the prevailing weather. The usual tables of data are included in the bulletin, but there are no maps nor other graphic representations. The institute has recently published a pamphlet summarizing and discussing the data obtained in the observatory during the last fourteen years (Luis Morandi: *Resumen y discusión de las observaciones meteorológicas del Observatorio Central, período 1901-1915*, Montevideo, 1917).

The Unique Currency of Nariño, Southern Colombia. The Republic of Colombia has issued a decree recalling the national silver coined before 1911 and the foreign money now in circulation. Conversion is to be effected by the Exchange Office in Bogotá and "such other exchange offices as the Government may deem it necessary to establish in the Department of Nariño and the Intendency of Chocó" (*Board of Trade Journ.*, June 28, 1917). The last statement is geographically interesting. In respect of Nariño it indicates a tussle anticipated by the Government. The peculiar monetary situation of Nariño has lately been described by A. C. Veatch in his "Quito to Bogotá" (New York, 1917). Nariño, the most southerly department of Colombia, is isolated by poor communications from the central Government. Its self-contained mountain basins shelter an independent people who care little for affairs beyond their own boundaries. Their obstinate provincialism finds expression in their singular currency. When the remainder of the republic adopted a gold basis Nariño refused to conform and enforced a local silver standard. It accepts at silver value coins of all nations and dates and hence has

become a happy depository for coins no longer current elsewhere. The most abundant coins are said to be the old 8-*reales* pieces of the first years of independence, but the currency as a whole is extraordinarily heterogeneous.

ASIA

The Physical Foundations of Babylonia. Babylonia owes its ancient fertility to the alluvium of two mighty rivers. The cities and towns which once covered this alluvial plain were products of the twin river basin. Many features of this basin proved favorable to humanity. The banks of the Euphrates were conveniently low so that the Babylonians found in them starting points from which to extend a system of canals to distribute far beyond the river the rich silt of its waters. This section of western Asia is one of scanty rainfall. The dependence of the inhabitants on the rivers was thereby increased.

An able sketch of these physical foundations has lately been presented by Professor A. T. Olmstead in a study entitled "The Political Development of Early Babylonia" (*Amer. Journ. of Semitic Languages and Literatures*, Vol. 33, 1917, pp. 283-321). He shows that the two rivers with their network of canals formed an irrigation unit which pointed to political union. A further cause that led to Babylonian unity was the pressure of the nomads from the deserts on the west and southwest. The slightest drought would send these raiders against the inhabitants of the irrigated lands. The only adequate protection against these encroachments lay in the political union of the settled population. The danger was all the greater because of the absence of natural frontiers in Babylonia. The steppe merges into the alluvium without marked transition save for a very low escarpment on the north and northwest.

Various conditions did not promote enterprise among the Babylonians. The climate with its seven months of intense heat bred indolence among them. The extraordinary fertility of the soil provided ample supplies of food, and the impulse to go forth in search of necessities was rarely felt. The country became a prey to the sturdier races of the mountains in Upper Mesopotamia or of the western edge of the Persian plateau. The Semitic invaders from the west or southwest likewise found in Babylonia a people lacking in energy. For a while superior civilization enabled the Babylonians to withstand the pressure of barbarian foes. Eventually, however, the empire failed in its resistance.

The Typhoon Warnings of the Zikawei Observatory, Shanghai. A late summer day in the China Seas—clammy heat, thick air under a leaden sky, an ever-increasing swell of the oily waters and presently a falling barometer: the ship's log records an approaching typhoon. If the track of the storm cannot be escaped then will follow an experience of thrilling adventure. Innumerable logs relate the bare facts of such adventures, and these alone stir the imagination, but the typhoon is fortunate in having an exceptional chronicler (Joseph Conrad in his novel "Typhoon"). If you would realize the incredible force of the tropical storm follow the course of the *Nan Shan* from the moment that the storm descended "formidable and swift, like the sudden smashing of a Vial of Wrath," engulfing the ship in a fury of air and water until she reaches the "sinister" calm of the center, the eye of the storm. An actual example of such a storm occurred as late as August, 1917. The *Army and Navy Journal* of October 6 (p. 188) publishes an account by Captain C. H. White, U. S. A., of the typhoon encountered by a United States transport from the Philippines when northeast of Formosa. The transport passed through the eye of the storm, "a lull with no air stirring and a calm sea with the barometer falling with nearly a perpendicular curve." The lowest pressure recorded was 27.98 inches, and the wind beyond the calm had an estimated velocity of between 125 and 130 miles an hour.

No part of the sailing routes of the Eastern Seas between Japan and the Philippines is free from these whirling storms, but in most instances a ship may escape fatality or serious damage if duly warned. A miscalculation lost the P. and O. liner *Bokhara* in the dangerous Pescadores Channel off the west coast of Formosa during the typhoon of October, 1892: knowledge of the locus of the storm center would have saved her (W. Kesslitz and K. Rössler: *Maritime Meteorologie*, Pola and Fiume, 1904, p. 125 and Fig. 14). It is to meteorological service that we look for such warnings. How a meteorological service can render invaluable assistance in safeguarding against tropical storms has been proved in the West Indies by the complete system of cable-reporting meteorological stations established by the United States since 1898. But the conditions which favor the development of the hurricane in the West Indies are still more favorable to the development of the typhoon in the Philippines. Doberck finds that, where, in the former, the storms average two a year, in the latter they average 19 (W. Doberck:

The Law of Storms in the Eastern Seas, 4th edit., *Hongkong Observatory Publ. No. 3*, Hongkong, 1904): moreover the storm-swept area is greater in the East than in the West. In the Philippines the meteorological system established at the same time as that of the West Indies has done important work. Farther north in the typhoon belt great honor is due to the labors of the Zikawei Observatory. The following account is based on a communication kindly sent to this Society by its present director, Father H. Gauthier, S. J.

Zikawei lies on the alluvial plains of the Yangtze-Kiang, 45 miles from the sea. Zikawei is one of many notable observatories founded and directed by the Society of Jesus. Another is the Central Observatory of Manila, under state patronage but still directed by members of the order. The Manila observatory has published several contributions to meteorology. Of them F. José Algué's "The Cyclones of the Far East" (Special Report of the Philippine Weather Bureau, 2nd edit., 1904) is the most valuable relative to the topic under discussion. Zikawei began its regular series of observations in 1873 under the direction of M. Dechevrens. Very shortly the observatory became known for its research work in the various departments of physical science for the study of which it was equipped—astronomy, terrestrial magnetism, meteorology, and, later, seismology. Not only were the studies of high theoretical value: they had direct practical bearings, especially those in meteorology. Naturally the tropical storm received attention from the first. As the present director remarks: "The study of cyclones which visit the mouth of the Yangtze was, in a special manner, forced upon a meteorological observatory established at Shanghai."

Publication of "The Typhoon of July 31, 1879" by M. Dechevrens created a tremendous impression among the merchants of Shanghai, and it may be said to mark the entry of the observatory into direct public service. The observatory commenced to furnish the local papers with weather reports, and the establishment of a typhoon signal service was discussed and voted for by the International Chamber of Commerce. In 1884, supported by the potent Chinese Maritime Customs, the service came into operation: a signal mast was erected on the borders of the French and the International Concessions, and it has functioned uninterruptedly ever since. To Zikawei as a center were sent observations from neighboring meteorological stations, and reports came from sea captains and other observers. Today there has been built up a complete network for the protection of China's coasts. Some of the co-operating stations are far distant, that of the Carolines, for instance, is 1,200 miles from Luzon. The code employed at Zikawei proved generally acceptable. In 1898 Sir Robert Hart introduced it into all the seaport stations under the Chinese Maritime Customs, and its merits were endorsed by W. F. Tyler, Inspector General of the China Coasts. "The principle at Zikawei is to keep the seaman well posted by supplying him with every information in hand. The position of a typhoon is signaled to him with precision as well as the direction it has followed, its course is observed, and every change of direction or of position is announced without delay." Today the code is being modified; a system of symbols will permit the mariner the necessary information without resource to any conventional code.

The meteorological data collected by the observatory are published in regular bulletin form and from time to time are made the subject of special memoirs. Many naturally pertain to typhoons, but on other meteorological topics there are such important papers as F. de Moidrey's "Notes on the Climate of Shanghai" (1904) and L. Froc's "La pluie en Chine durant une période de onze années, 1900-1910" (1912; reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, p. 380). Besides contributing to our knowledge of a particular region, one, too, of great commercial interest, the problems dealt with in Zikawei are contributing to the progress of our comprehension of the general physics of the atmosphere.

AUSTRALASIA AND OCEANIA

Completion of Australia's First Transcontinental Railroad. The building of a transcontinental railroad must always rank as a notable achievement, and doubly so must be reckoned the completion in war-time of Australia's first transcontinental line (*Munsey's Magazine*, August, 1917, p. 510; cf. also *Board of Trade Journ.*, June 28, 1917, p. 710). The systems in the east and the west are now united along the southern edge of the continent by the link between Kalgoorlie, West Australia, and Port Augusta, South Australia, and today the traveler can go from Perth to a point in Queensland in 19° south latitude (Townsville) 4,000 miles by continuous rail journey. The connecting link measures over 1,000 miles. Throughout its length until Port Augusta is reached it traverses a country with an average annual rainfall of under 10 inches. For long stretches potable surface water is absent save for an occasional temporary rock hole or soak. Such is the case for the first 180 miles out of Kalgoorlie, where, moreover,

borings have failed to prove the existence of underground water and the railroad is dependent on meteoric waters stored in great reservoirs built to hold several million gallons (Chas. G. Gibson: *The Geological Features of the Country Lying Along the Route of the Proposed Transcontinental Railway in Western Australia*, *Geol. Survey of W. Australia Bull.* 37, 1909). When the sand-buried granitic terrain, with its characteristic desert vegetation of spinifex and mallee, is left for the limestone country to the east, the question of water is somewhat ameliorated. By sinking bores to a sufficient depth, water, albeit sometimes brackish, is always obtainable. Level, treeless saltbush plains characterize the limestone: they offer definite pastoral possibilities. Beyond the limestone the railroad runs through a belt of ancient auriferous rocks. The gold and copper of Tarcoola have been in exploitation for some time, but the mineral potentialities of the entire belt are little known: the prospects are said to be good. From Tarcoola the line runs southeast through occupied pastoral country to Port Augusta at the head of Spencer Gulf. The line will be of the greatest service in the expedition of passengers and mail. It adds to the unity of the Commonwealth and provides an important measure of strategic defense.

HUMAN GEOGRAPHY

Sunshine in Its Relation to City-Planning. The importance of the angle of sunshine, of exposure to sunshine, and of the varying intensity of insolation at different latitudes in their effects on problems of public health, municipal expenditures, etc., is strikingly brought out by Messrs. H. S. Swan and G. W. Tuttle in an article entitled "Planning Sunlight Cities" (*The American City*, Sept. and Oct., 1917, New York). Emphasis is laid on the need of scientific determination of optimum building heights, street widths, and street orientation. Shadows cast by tall buildings deprive great areas of needed sunlight. The Woolworth Building in New York, 791 feet high, casts a shadow 1,635 feet long at noon on December 21. The Equitable Building, 493 feet high, casts a shadow 1,018 feet long, covering 7.59 acres, on the same date. Tables are presented showing in great detail the sunshine period at ground level of streets, for different latitudes, and for each side of streets of different orientations improved with buildings of various heights. Thus Winnipeg, Canada, has on December 21 only two-thirds the equatorial duration of sunshine. For direct sunlight to reach the north curbs of east-west streets at noon, the buildings on the south sides of the streets would have to be only three-tenths as high as the streets are wide. At the equator on the same date a height equal to 2.31 times the street width is possible. The attainment of ideal sunshine conditions for east-west streets would obviously lead to economically impossible relations of street width to building height. The problem does not concern so vitally the location of detached houses; here the requisite sunlight can "be purchased more cheaply on an east-west street than on a north-south street." In the case of city blocks of attached dwellings, the conclusion is reached that such blocks should have their longer dimension on north-south streets only. East and west fronts thereby receive equal amount of sunshine. The number of east-west streets need be determined simply on the basis of traffic requirements, as the length of blocks north and south has no effect on the amount of sunshine received. These east-west streets have their sunshine conditions least affected at low latitudes, but at high latitudes the north side of the street becomes nearly, if not quite, as undesirable as the south side. The fullest possible utilization of diffuse daylight by means of large windows is important in this connection. The north-south orientation of streets would allow the most economical use of the land (by permitting buildings of equal height on both sides of the street) and would make possible the maximum practicable use of the sunshine received at a given latitude. "What is needed for the promotion of good housing today quite as much as restrictive regulations is the definition of scientific standards which will directly relate height and area provisions to the minimum requirements of public health."

B. M. VARNEY.

GEOGRAPHICAL NEWS

PERSONAL

MR. THEODORE DE BOOY of the Museum of the American Indian, Heye Foundation, of New York, gave a lecture on November 7 before the Geographical Society of Philadelphia on "The Virgin Islands."

DR. SALVADOR DEBENEDETTI has been appointed director of the Ethnographical Museum of the University of Buenos Aires and chief of its archeological expeditions, to succeed Dr. Juan B. Ambrosetti, who died on May 28.

PROFESSOR O. D. VON ENGELN of Cornell University addressed the Physiographers' Club of Columbia University on November 23 on "Types of Alaskan Glaciers and Features of the Associated Deposits."

MR. EARL F. CHURCH, who accompanied Dr. Hamilton Rice's Amazon expedition of 1916-17 as topographer, has, with other members of the personnel of the U. S. Coast and Geodetic Survey, been transferred by executive order of September 24 to the service and jurisdiction of the War Department with the grade of First Lieutenant, U. S. R.

DR. E. O. HOVEY of the American Museum of Natural History read a paper on November 19 before the New York Academy of Sciences on "The Geology of the Greenland Coast from North Star Bay to Cape York."

DR. ELLSWORTH HUNTINGTON gave a lecture on October 26 before the Geographic Society of Chicago entitled "The Turks and the Euphrates."

DR. OTTO KLOTZ, whose article on the history of the forty-ninth parallel boundary surveys in the May, 1917, number of the *Review* will be recalled, has been appointed Chief Astronomer and Director of the Dominion Astronomical Observatory at Ottawa, Canada.

PROFESSOR R. D. SALISBURY of the University of Chicago spoke on "Geography and Geology Work about Camp Grant," the National Army cantonment at Rockford in northern Illinois, at the Post-Vacation Luncheon of the Geographic Society at Chicago, on November 17.

DR. CARL SKOTTSBERG of the University of Upsala, Sweden, read a paper before the Torrey Botanical Club on November 13 entitled "An Account of a Visit to the Juan Fernandez Islands."

MR. EUGENE VAN CLEEF of the State Normal School of Duluth, Minnesota, addressed the Duluth members of Sigma Xi on September 25 on "Modern Geography and City Progress."

OBITUARY

DR. WILLIAM BULLOCK CLARK, state geologist of Maryland, died on July 27 at the age of 57. Dr. Clark had been at the head of the Maryland Geological Survey since its organization in 1896; professor of geology at Johns Hopkins University since 1894; and director of the Maryland Weather Service since 1891. From 1900 to 1906 he was commissioner for Maryland in the resurvey of the Mason and Dixon line. Dr. Clark's interests were wide, a breadth of view that is reflected in the wide range of related subjects which are represented in the publications of the organizations of which he was the head. His own writings of geographical bearing are: "The Physical Features of Maryland" (with E. B. Mathews; Part I of Vol. 6 of the reports of the Maryland Geological Survey, 1906) and "The Relations of Maryland Topography, Climate, and Geology to Highway Construction" (*ibid.*, Part II of Vol. 3, 1899).

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

General

BACON, R. F., AND W. A. HAMOR. **The American petroleum industry.** Vol. 1: x and 446 pp.; Vol. 2: vi and pp. 447-963. Maps, diagrs., ill., glossary, index. With special chapters in Vol. 1 by F. G. Clapp, R. H. Johnson, J. P. Cappeau, and I. G. Huntley. McGraw-Hill Book Co., Inc., New York, 1916. \$10 for 2 vols. 9½ x 6.

This two-volume work is in some respects similar to the well-known English publication by Redwood. The first two chapters deal with the properties and origin of petroleum and its geology, these chapters being followed by one on the distribution of petroleum in the United States, in which much of the information is in condensed and tabulated form. Even though the book is professedly compiled for American usage, a few pages on foreign deposits, especially those of Canada and Mexico, would have been welcome. Geographers will be especially interested in the 75 pages of Chapter 5 devoted to the history of the petroleum industry, starting with the first mention of oil in Allegany County, New York, in 1627.

The succeeding chapters deal mainly with the technique of production. Some of the topics discussed are: oil well technology, valuation of oil properties, petroleum technology, and the extraction of gasoline from natural gas. A short but interesting chapter entitled "Some Problems of the Petroleum Industry" points out the great benefit that may be derived from industrial research, as in the line of perfecting refining processes, the development of uniformity of testing and analytical methods, and flexibility of refining so as to produce only such products as are in demand. The chapter on the shale oil industry is also timely in view of the interest that oil shales have been arousing, although the authors point out that there is little probability that these materials will be in demand until our oil and possibly coal supplies have been depleted.

The work closes with a glossary of *bitumenology*, a term that is reasonable although somewhat unique. The illustrations are on the whole good, but the map of distribution of oil and gas opposite page 70 is indistinct because of an overcrowded base and could be greatly improved.

H. RIES.

GRANT, MADISON. **War and race: Some biological notes on war.** *The Chronicle*, Vol. 1, 1917, No. 6, pp. [14-15]. New York.

A brief but strikingly suggestive and thoughtful paper on the biological results of the present war. There is outlined the effect of the Civil War in diminishing the virile type of man in New England through losses on Southern battlefields. The following quotations indicate the seriousness of the problem that the intensive struggle of today may bring to America.

"Will the teeming thousands from the East Side of New York contribute to the recruits or will they confine their devotion to their new found home, to pacifist, socialist, or anarchic meetings of protest against conscription?"

"If the various elements, racial and social, which compose our motley metropolitan populations, be not compelled to perform each its allotted share in the actual fighting, then the races and classes who do the fighting will suffer numerically much more than those who remain at home and breed in security."

"We have welcomed these aliens here and diluted our citizenship by sharing our rights and privileges with them and we have done this to solve a labor problem quite as much as from a desire to furnish a home for the oppressed of the world, although some sentimentalists think otherwise.

"Having admitted them to share our franchise and wealth shall we compel them to share the burdens of the defense of the nation or shall we do their fighting for them? The readiness that native Americans have shown in manfully and cheerfully accepting conscription gives a partial answer to this question, but the great mass of these foreigners, especially those of Levantine origin, near or remote, will slip through the draft-net

because of physical disability and thus escape the shock of battle. The Army demands only perfect specimens of manhood—no flat-feet, no stunted stature, or bleared eyes will do for the fighting line, but these are considered good enough, under our present system, to breed the future population of our country."

GREELEY, W. B. **Some public and economic aspects of the lumber industry. Part 1: Studies of the lumber industry.** 100 pp.; maps, diagrs. *U. S. Dept. of Agric. Rept. No. 114* (contribution from The Forest Service). Washington, D. C., 1917.

The Forest Service has given, in a readable form, the results of its recent investigation into the great problems associated with the lumber industry in the United States. This pamphlet condenses what must have been a mountain of notes in the rough. For one either unacquainted or even quite familiar with the industry, surely here is a treatise worthy of study. The several maps showing various important facts of distribution and the graphs relating to production, prices, investments, and other closely related data, aid materially in making clear the arguments of the text. The present conditions of the lumber industry, some of the causes of these conditions, the part the public has played and should play, and some suggestions for the future success of forestry in this country constitute the main topics of the pamphlet. The discussion is so full of striking and pertinent revelations to the uninitiated that instead of citing quotations one prefers to recommend that it be read in its entirety.

EUGENE VAN CLEEF.

JOHNSON, E. R., T. W. VAN METRE, G. G. HUEBNER, AND D. S. HANCHETT. **History of domestic and foreign commerce of the United States.** With an introductory note by H. W. Farnam. Maps, bibliogr., index. Vol. 1: xv and 363 pp.; Vol. 2: ix and 398 pp. Carnegie Institution of Washington, Washington, D. C., 1915. \$5.40 for 2 vols. 10 x 7.

The first of a series of volumes, presumably twelve, to be prepared by the heads of the different divisions of the Department of Economics and Sociology of the Carnegie Institution and constituting "Contributions to American Economic History." The material upon which these master volumes is based has been in the process of collection since 1903, and numerous monographs have been published from time to time. Naturally, however, American economists have been awaiting, with particular interest, the more comprehensive volumes; and, in view of the present widespread interest in American commerce, the appearance of Professor Johnson's contribution as head of the Division of Domestic and Foreign Commerce is most timely.

Each volume consists of three parts. Part I of the first volume treats of American commerce from its crude beginnings down to 1789 and was written, largely, by Professor Johnson himself. Parts II and III were prepared by Dr. Van Metre and deal, respectively, with our internal commerce and the coastwise trade. Part I of the second volume is devoted to a discussion of the foreign trade of the United States since 1789 and was written, chiefly, by Professor Huebner. Parts II and III were contributed respectively by Drs. Van Metre and Hanchett and deal with the fisheries, governmental aid to commerce, and commercial policy.

American economists, especially those interested in economic history, will find in these volumes a good deal of valuable material. The student of American economic geography also would do well to give this work a careful perusal. For geographers in general, the chief interest in these volumes will be derived from the fact that they are appropriately introduced by an interesting chapter from the pen of Professor Johnson entitled "Geographical Influences Affecting the Early Development of American Commerce." The point of view of the author is well expressed on pages 3 and 4, where he says: "The economic conditions that control the development of industry and commerce are partly natural or geographic and partly artificial or of man's creation. The earth, as the field of human endeavor, broadly controls what man may do; it may bestow free gifts upon mankind; it may, and more often does, place obstacles, more or less difficult to surmount or circumvent, between man and the goal of his efforts; or it may fix definite limits beyond which it is vain to attempt to pass. At the time of the settlement of America, three centuries ago, industry and commerce were aided but slightly by the mechanical agencies which now enable men to modify, direct, and turn to their service the conditions imposed by their physical environment. Geographic conditions exercised such a strong influence upon the economic development of America that the history of American commerce should begin with a survey of the geography of the North Atlantic and the eastern part of North America. In making this survey, it will be best to consider the geographic control of both industry and commerce."

AVARD L. BISHOP.

ASHLEY, G. H. **Oil resources of black shales of the Eastern United States.** *U. S. Geol. Survey Bull. 641-L*, pp. 311-324. Washington, D. C., 1917.

BAIN, H. F. **Prospects for tin in the United States.** *83rd Ann. Rept. Roy. Cornwall Polytechnic Soc.*, Vol. 3, 1916, Part 2, pp. 114-128 (discussion, pp. 125-128). Plymouth.

CELESIA DI VEGLIASCO, A. G. **Considerazioni economiche sugli Stati Uniti d'America, prima, dopo, e durante la guerra europea.** 59 pp. [*Boll.*] *Direz. Gen. degli Affari Comm.*, 1916, No. 5. Minist. degli Affari Esteri, Rome, 1916.

— **Coal industry of the United States in 1914.** The. Ill. *Mining and Engineering World*, Vol. 42, 1915, No. 6, pp. 290-293.

COTTERILL, R. S. **Southern railroads and Western trade, 1840-1850.** Map. *Mississippi Valley Hist. Rev.*, Vol. 3, 1917, No. 4, pp. 427-441.

DAVIS, W. M. **Topographic maps of the United States.** Maps. *Natl. Highways Assoc. Physiographic Bull.* No. 1, 1917, May, pp. 1-16. Washington, D. C. [Abstracted in the June, 1917, *Review* (Vol. 3, p. 490).]

DU BOIS, W. E. B. **The suppression of the African slave-trade to the United States of America, 1638-1870.** 3rd edit. xi and 335 pp.; diagr., bibliogr., index. (*Harvard Historical Studies*, Vol. 1.) Harvard University Press, Cambridge, 1916 (1st edit. 1896). \$1.50. 9 x 6.

ELY, R. T. **Landed property as an economic concept and as a field of research.** *Amer. Economic Rev.*, Vol. 7, 1917, No. 1, Suppl., pp. 18-48 (discussion, pp. 34-48). [Outlines land classifications to meet economic and legislative needs in the United States and suggests problems of research on landed property.]

EMERSON, F. V. **Geographic influences in the Mississippi Valley.** *Louisiana State Univ. Bull.*, Vol. 7, 1916, No. 7 (reprinted from *Proc. Mississippi Valley Hist. Assoc. for the year 1914-15*, Vol. 8, pp. 289-296). [Suggestions on the place of geography in historical study.]

FROTHINGHAM, E. H. **The status and value of farm woodlots in the eastern United States.** 43 pp.; maps, diagrs. *U. S. Dept. of Agric. Bull.* No. 481. Washington, D. C., 1917.

GRINNELL, G. B. **Recollections of the Old West: Appreciation of the historical canvases of Indian and pioneer American life painted by William de la Montagne Cary.** Ills. *American Museum Journ.*, Vol. 17, 1917, No. 5, pp. 333-340.

HENRY, A. J. **Snow studies in the United States.** Bibliogr. *Monthly Weather Rev.*, Vol. 45, 1917, pp. 102-113. [A discussion of the density of snow and a historical discussion of the measurement of snow in the United States. There is also a note on the disappearance and settling of snow in 1915-16 near Reno, Nev., by H. F. Alciatore. —R. DEC. W.]

North Atlantic States

BUFFINTON, A. H. **New England and the Western fur trade, 1629-1675.** *Publs. of the Colonial Soc. of Massachusetts*, Vol. 18, 1916, pp. 160-192.

This paper is a careful study of the early commercial development of New England. Fur trading with the Indians was the initial industry of the first New Englanders. It was the profit from fish and fur that attracted Captain John Smith. Fur trading in 1629 was declared a monopoly of the Massachusetts Bay Company, and its proceeds were used for forts and churches. In 1640 Thomas Lechford considered the fur trade the chief industry of Massachusetts. In the early days the geography of the New England streams was somewhat hazy, as when the traders of Plymouth considered the Merrimac and the Connecticut as having their headwaters in the rich beaver country about Lake Champlain or the Lake of the Iroquois. The New England traders were cut off from direct access to the principal sources of furs to the westward by the north-to-south trend of their streams, and by the claims of the Dutch and the French. The Dutch at New Netherlands held the open door to the Hudson River, and the French controlled the St. Lawrence and the Great Lakes. The establishment by English traders in 1636 of Springfield on the Connecticut River was the first move to the trade invasion of the Dutch territory.

The Massachusetts merchants early realized that to compete with the Dutch in the fur trade they must get a foothold on the Hudson River, and their sea-to-sea charter gave them some claims at least to the upper portion of this stream. This boundary quarrel between the Dutch and the English traders was changed in 1664 with the fall of the Dutch Governor, Stuyvesant, from an international affair to a colonial boundary dispute, in which considerable feeling developed between New York and Massachusetts. This paper shows how the single factor of fur trading was important in the attempts of Massachusetts to expand her early trade westward.

W. M. GREGORY.

HARSHBERGER, J. W. **The vegetation of the New Jersey pine-barrens: An ecologic investigation.** xi and 329 pp.; maps, diagrs., ills., index. Christopher Sower Co., Philadelphia, 1916. \$5.00. $9\frac{1}{2} \times 6\frac{1}{2}$.

The New Jersey pine-barrens, notwithstanding their close proximity to New York and Philadelphia, represent one of the largest areas of primeval wilderness in the eastern United States. For fully a century and a half this region has been celebrated among botanists as the center of a unique flora, quite different from that which characterizes the adjoining parts of the coastal plain and the piedmont region west of the fall-line. As has been pointed out by Witmer Stone in his excellent account of the flora of the New Jersey coastal plain (*Ann. Rept. New Jersey State Museum*, 1910, Trenton, 1911, pp. 22-828), the pine-barren flora includes eighteen vascular plants of northward distribution which reach their southern limit, and seventy species of southward distribution which reach their northern limit along the coast in New Jersey. It also forms the apparent center of distribution for seventeen vascular plants which range from Massachusetts to Delaware or are even more restricted in their distribution. The geographical significance of these and certain related facts has been discussed by Hollick (*Trans. New York Acad. Sci.*, Vol. 12, 1893, pp. 189-202), Harshberger (*Phytogeographic Survey of North America*, 1911, pp. 219-221), Fernald (*Rhodora*, Vol. 13, 1911, pp. 109-162), Taylor (*Torreyia*, Vol. 12, 1912, pp. 229-242), and others.

As first clearly delimited from surrounding parts of the coastal plain by Stone, the pine-barren vegetation in Stone's flora leaves little to be desired along floristic lines. The significance of this fact, as re-emphasized by Harshberger in the present volume, seems to be that the vegetation of the pine-barrens represents an isolated relict of a Miocene coastal plain flora, the perpetuation of which is to be attributed to the fact that the area which it occupies, in contrast to adjoining portions of the coastal plain, has been uninterruptedly out of the water since upper Miocene times. The treatment of the pine-barren vegetation in Stone's flora leaves little to be desired along floristic lines. The present work is an equally comprehensive treatment along ecological lines. The value of such a piece of investigation on the vegetation of this area, representing "an old and climax condition, ancestrally infinitely more ancient than anything in the surrounding region" (Taylor, *loc. cit.*, p. 242), hardly requires comment. Harshberger has discussed the vegetation from all angles, synecological and autecological, while many subjects are introduced which are of general rather than ecological interest. Nine natural plant formations are distinguished and described in considerable detail: the pine-barren, plains, cedar swamp, deciduous swamp, savanna, marsh, pond, river bank, and bog formations. As a result of the disturbance of primeval conditions various temporary successional formations may arise, but under natural conditions the vegetation for the most part is stable, the formations permanent, and the phenomena of succession lacking. In connection with the study of the formations, an extensive series of studies has been made on the soils of the region and on the root and shoot characters of individual plants.

GEORGE E. NICHOLS.

BEALS, C. E., JR. **Passaconaway in the White Mountains.** 343 pp.; ills., index. Richard G. Badger, Boston, and The Copp Clark Co., Ltd., Toronto, 1916. \$1.50. $8 \times 5\frac{1}{2}$. [A popular account of scenery, Indian legends, history of exploration, settlements, and adventures in the White Mountains.]

BENT, A. H. **Mount Monadnock.** Ill. *Appalachia*, Vol. 14, 1917, No. 2, pp. 109-119.

BONNAFFON, S. A. **Hell Gate Bridge: Some of the engineering features of the world's greatest steel arch bridge, and its place in the American railway system.** Ills. *Commercial America*, Vol. 13, 1917, No. 10, pp. 27 and 29. [Abstracted in the June, 1917, *Review* (Vol. 3, p. 486).]

BRADLEE, F. B. C. **The Eastern Railroad: A historical account of early railroad-ing in eastern New England.** Ills. *Essex Inst. Hist. Collections*, Vol. 52, 1916, No. 3, pp. 241-272.

— **Bronx Parkway Commission, Report of the.** 151 pp.; map, diagr., ills. Bronx Parkway Commission, New York, 1916. 10×7 .

COVILLE, F. V. **The wild blueberry tamed: The new industry of the pine barrens of New Jersey.** Ills. *Natl. Geogr. Mag.*, Vol. 29, 1916, No. 6, pp. 535-546.

ELLIS, A. J. **Ground water in the Waterbury area, Connecticut.** 72 pp.; maps, diagrs., ills., index. *U. S. Geol. Survey Water-Supply Paper 397*. Washington, D. C., 1916.

North-Central States

LEVERETT, FRANK, AND F. W. SARDESON. **Surface formations and agricultural conditions of northeastern Minnesota.** With a chapter on climatic conditions of Minnesota by U. G. Purssell. vi and 72 pp.; maps, diagrs., ills. *Minnesota Geol. Survey Bull. No. 13.* Univ. of Minn., 1917.

A detailed report on a limited geographic area rises above the commonplace to the degree to which principles and generalizations are developed by the author. It is this feature that characterizes the present well-illustrated and carefully prepared paper. The longest chapter deals with agricultural conditions and land classification in the north-eastern quarter of Minnesota. Not only are the descriptions of the individual counties unusually good but the introduction to the chapter is exceptionally valuable in the regional geography of the state. The sections on glacial features in earlier chapters deserve special praise for their summary accounts and concise statement of conclusions drawn from the senior author's most recent studies over a wide area in the Great Lakes region. Noteworthy in this respect are the remarks on the Patrician ice sheet which preceded the Keewatin and Labrador sheets. The correlation of ice markings, surface changes, and distinctive drift deposits, with each of these three ice sheets is of very wide interest although a little difficult to get at because related items are distributed among the sectional topics—doubtless a condition imposed by the nature of the report. For the discussion of the ice sheet one should read pp. 16-17 and 47-49. Especially interesting are the remarks on p. 53 concerning the coalescence of the Labrador and Keewatin ice sheets and the distinctive surface features created thereby.

MERK, FREDERICK. **Economic history of Wisconsin during the Civil War decade.** 414 pp.; map, diagr., ills., index. (*Wisconsin Historical Studies*, Vol. 1, M. M. Quaife, edit.) State Historical Society of Wisconsin, Madison, 1916. 10 x 7.

Here is a volume in history that is full of geographic material. It might almost be called the economic geography of Wisconsin, save that it treats of a particular period. The author recognizes, however, that Wisconsin is only a political community, not a geographical or an economic unit, and his work describes conditions which existed in parts of neighboring states as well.

The development of Mississippi River commerce is traced—its struggle to retain its place against the invasion of railroads, its contrast with the commerce of the Great Lakes. The dependence of Wisconsin cities upon the development of their hinterland and their relation to routes of trade are brought out. The transition from wheat growing to dairying, as a result of the state's endowment of pure water and grass, is of interest in the light of the present importance of the latter industry. Lumbering is described not only in relation to the amount and method of production but also as influenced by rivers, lake routes, and the geographical location of the timber lands. The book is a distinct addition to the human geography of Wisconsin. It blazes a trail which others may well follow in what is almost a pioneer field, that of state economic geography and history. It is a good companion volume to Lawrence Martin's "Physical Geography of Wisconsin" noticed in the *Review* for March, 1917, p. 248. See also "Geographical Influences in the Development of Wisconsin" by Mary Dopp, a series of articles published in the *Bulletin of the American Geographical Society*, Vol. 45, 1913.

SAUER, C. O. **Geography of the upper Illinois valley and history of development.** 208 pp.; maps, diagrs., ills., index. [*Illinois*] *State Geol. Survey Bull. 27.* Urbana, 1916.

An important paper on the east-west portion of the upper Illinois valley between Joliet and Hennepin. It is divided into two sections, the first of which occupies 143 pages and is physiographic and geologic in character, following somewhat the general lines of similar reports in this and other state surveys. Except for a short section entitled "Relation of Topography to Occupations of Man" (pp. 24-28), the human geography is found in Chapter 7, "Settlement and Development of Upper Illinois Valley" (pp. 144-203). Chapter 7 is chiefly an account of geographic influences in the settlement of the region. It traces the origin of the settlers, outlines the pioneer conditions of life as to transportation and agriculture, and pays particular attention to railroad building and manufactures.

BABER, ZONIA. **Stony Island [Chicago]: A plea for its conservation.** 16 pp.; maps, diagr., ills. *Geogr. Soc. of Chicago Excurs. Bull. No. 3.* University of Chicago Press, Chicago, 1917. 11 cents. 9 x 6.

BLAIR, W. R. **Sounding balloon ascensions at Fort Omaha, Nebr., May 8, 1916.** Diagr., *Monthly Weather Rev. Suppl. No. 3*, pp. 9-10. Weather Bureau, Washington, D. C., 1916.

— **Boundary dispute, retracing an old survey to settle.** Map, diagr. *Engineering News*, Vol. 76, 1916, Dec. 28, pp. 1234-1235. [Deals with the Ohio-Michigan boundary. Abstracted in the February, 1917, *Review* (Vol. 3, p. 147).]

CARNEY, FRANK. **Some pro-glacial lake shorelines of the Bellevue quadrangle, Ohio.** Maps, diagr. Reprinted from *Bull. of the Sci. Laboratories of Denison Univ.*, Vol. 17, 1913, pp. 231-246.

COOK, C. W. **The influence of the lumber industry upon the salt industry of Michigan.** Maps, diagr. *Journ. of Geogr.*, Vol. 15, 1916-17, No. 4, pp. 117-125.

CRAWFORD, RUTH. **The immigrant in St. Louis: A survey.** Bibliogr. *Studies in Social Economics*, Vol. 1, 1916, No. 2, pp. 1-108. St. Louis. 50 cents.

FENNEMAN, N. M. **Geology of Cincinnati and vicinity.** 207 pp.; maps, diagr., ills., index. *Geol. Survey of Ohio Bull. 19*, 4th Ser. Columbus, 1916. [Although primarily geological in character this report contains a physiographic section, Chapter VI, "History of the Present Surface," which contains items of unusual interest relating to the soil and particularly the loess, and is illustrated by a sketch of the preglacial drainage in the Cincinnati-Hamilton area (Fig. 48). The report, while intended for local use, contains so many physiographic interpretations that are carefully worked out as to be of wider interest than its title would imply.]

FOSTER, H. M. **Memories of the National Road.** *Indiana Mag. of Hist.*, Vol. 13, 1917, No. 1, pp. 60-66. [The National Road was the one great highway to the West from 1818 to 1852. It began at Cumberland, Md., and passed through Maryland, Pennsylvania, Virginia, Ohio, Indiana, till it was lost in the prairies of Illinois.]

FRITSCH, W. A. **German settlers and German settlements in Indiana: A memorial for the State Centennial, 1916.** 62 pp. [The Speed Press], Evansville, 1915. 50 cents. 7 x 5.

HERRON, W. H. **Profile surveys of rivers in Wisconsin.** 16 pp.; maps, diagr. *U. S. Geol. Survey Water-Supply Paper 417*. Washington, D. C., 1917.

— **Iowa, Census of, for the year 1915.** cxxxvi and 777 pp.; maps, index. Executive Council of the State of Iowa, Des Moines, [1916].

— **Iowa Geological Survey, Annual report: Vol. 25, 1914, with accompanying papers.** xxiii and 627 pp.; maps, diagr., ills., index. Des Moines, 1916.

KING, I. F. **Flatboating on the Ohio River.** *Ohio Archaeolog. and Hist. Quart.*, Vol. 26, 1917, No. 1, pp. 78-81.

Western States

CHAPMAN, C. E. **The founding of Spanish California: The northwestward expansion of New Spain, 1687-1783.** xxxii and 485 pp.; maps, ills., bibliogr., index. The Macmillan Co., New York, 1916. \$3.50. 9 x 6.

This interesting and scholarly study of the northwestward expansion of New Spain in the exploration and settlement of Spanish California is focused upon merely the central part of that brief period from the founding of San Diego in 1769 to the abandonment in 1783 of the overland route from Mexico to Alta California, an event following closely on the massacre by the Yuma Indians of the Spanish settlers on the lower Colorado River. The interest of the reader, however, is by no means confined to the brief central epoch of from 1773 to 1776; for Dr. Chapman, in illuminating that period, devotes seven preliminary chapters to the "advance of the Spanish conquest overland toward the Colorado and Gila Rivers from 1521 to 1773" and adds two concluding chapters throwing light on succeeding events up to the discovery of gold in 1848. When to this broad treatment of the special study is added the author's declared intention to trace in the first place "those influences that were at work prior to the nineteenth century whose tendency was to preserve Alta (or American) California, perhaps also Oregon and Washington, for ultimate acquisition by the United States," it is easily seen that this technically limited study is nevertheless broad enough to clarify the general reader's ideas of Spanish-American history from the time of Cortez to the present day.

To the trained historian naturally belongs any critical review of this important contribution to our knowledge of these early events so fundamental to our understanding of the spirit of civilization in the southwestern United States. Students in other fields, however, can appreciate the two years of painstaking study given by the author to the

original Spanish documents in the Archivo General de Indias at Seville and the extensive reading and study necessary to produce such a work with its wealth of footnote citations for specialists. The general reader will also appreciate the author's clear analysis of the scheme of the book in the preface and his method of giving in the opening paragraph of each chapter an interpretation and summary of the succeeding details gleaned from the original records.

To the geographer the specific interest of the book lies in the account of the exploration of a new land as told by the official reports and letters of the men who led the advance. Their persistent struggles, not always successful, against a decidedly unfavorable geographic environment, are brought into high relief by the necessities of the national policies. In the contest between the states of Europe for the acquisition of colonies in the New World, Spain feared that other nations, Russia and England particularly, might forestall her in getting a foothold in Alta California and from that vantage point possibly menace her southern possessions. Dr. Chapman's investigations throw great light upon the influence of this motive during the greater part of the eighteenth century, thus enabling the reader to understand the long and strenuous efforts for further expansion before the colonies already established were fully developed. In order to make and to defend these new settlements a line of communication and supply was an imperative necessity. The apparently open sea route, although always in use to some extent, had been found insufficient partly because of the small size and the scarcity of ships but largely because of storms and unfavorable wind conditions. Many instances of delay or disaster are cited, of which the following are illustrations: "Otondo spent over two months trying to get across the Gulf and then did it in one night." "The *San Carlos* had at length reached Loreto on August 23, after a voyage of nearly seven months from San Blas. It had been blown nearly to Panamá by storms."

In spite of these difficulties the Gulf of California had been crossed, and by strenuous efforts some missions established along the 800 miles of arid mountain waste of Baja California. They were maintained with difficulty and proved entirely unsuitable as a line of supply and communication.

It was therefore thought necessary to open and maintain an overland route through northwestern Mexico across the Colorado River into Alta California. The physical difficulties were great, and the hostility of the Indians was feared. The aridity and consequent barrenness of much of the country are comparable, broadly speaking, to conditions in the Sahara. In both instances the climatic conditions are the result of a like location on the western border of a continent facing an ocean in the latitude of the trade winds. After long years of undeveloped projects and the slow accumulation of information the first Anza expedition in 1774 successfully made the trip, crossing the Gila and Colorado Rivers near their junction and, after some suffering and loss of animals, finally traversed the deserts, reaching Mission San Gabriel by way of San Felipe Canyon without the loss of a man. In the following year this overland route was successfully used in taking colonists and supplies to Alta California by the second Anza expedition composed of 240 men, women, and children, and more than a thousand domestic animals. Although there was great suffering and many animals perished in the desert no human life was lost. To appreciate this great achievement with the meager equipment of the period we should recall the many deaths among those crossing the same desert in the gold rush to California in later days.

RULIFF S. HOLWAY.

— **Big Horn Canyon, Power and irrigation project for the.** Maps, diags., ills. *Railway Rev.*, Vol. 59, 1916, No. 14, pp. 436-448. [Describes the project to build a dam 480 feet high in the canyon of the Big Horn River, Montana. A large tract of land nearby could be irrigated and power developed for a projected 68-mile electric railway. There are sections on the scenic beauty of the canyon, surveys and explorations in it, the dam, the railway, and irrigation. The photographs are the best ever published on the region (see item under "Gillette, Edward," below).]

CUPPER, P. A. [Oregon] State Engineer's river survey guides water adjudicators. *Engineering News*, Vol. 76, 1916, July 6, pp. 5-6.

DANIELS, MARK. Crater Lake National Park. Ills. *Amer. Forestry*, No. 274, Vol. 22, 1916, pp. 586-592.

DANIELS, MARK. Glacier National Park. Ills. *Amer. Forestry*, No. 271, Vol. 22, 1916, pp. 397-404.

DANIELS, MARK. Mesa Verde and Casa Grande National Parks. Ills. *Amer. Forestry*, No. 267, Vol. 22, 1916, pp. 139-145.

DANIELS, MARK. Mount Rainier National Park. Ills. *Amer. Forestry*, No. 273, Vol. 22, 1916, pp. 529-536.

DANIELS, MARK. **The Yosemite National Park.** Ills. *Amer. Forestry*, No. 270, Vol. 22, 1916, pp. 345-352.

DANIELS, MARK. **Yellowstone National Park.** Ills. *Amer. Forestry*, No. 272, Vol. 22, 1916, pp. 458-463.

EDWARDS, M. G. **The resources of California.** *Journ. of Geogr.*, Vol. 15, 1916-17, No. 8, pp. 259-263.

ELLIOTT, T. C. **The Dalles-Celilo portage: Its history and influence.** 42 pp.; ill. The Ivy Press, Portland, Oregon, 1915. 9½ x 6.

FERGUSON, H. G. **Placer deposits of the Manhattan district, Nevada.** Maps, diagr. *U. S. Geol. Survey Bull.* 640-J, pp. 163-193. Washington, D. C., 1917.

FEWKES, J. W. **The first pueblo ruin in Colorado mentioned in Spanish documents.** *Science*, No. 1185, Vol. 46, 1917, Sept. 14, pp. 255-256.

GILLETTE, EDWARD. **The first trip through Big Horn Canyon.** 7 pp. Sheridan, Wyoming. [An undated report, obviously of recent publication, on a hazardous journey down the Big Horn Canyon in March, 1891. The ice was three feet thick and the temperature 20° below zero F. Alternating cliffs and talus slopes abound; and at one point the walls are 1,000 feet high. Rapids occur immediately below the mouths of the larger tributaries. One infers, from the description, the existence of a number of hanging valleys of a rare kind—due to the weak tributaries of a young and powerful stream incised in hard rock. (See the entry above, "Big Horn Canyon, Power and irrigation project for the".)]

GREGORY, H. E. **The Navajo country: A geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah.** 219 pp.; maps, diagrs., ill., bibliogr., index. *U. S. Geol. Survey Water-Supply Paper* 380. Washington, D. C., 1916. [Abstracted in the *September Review*, p. 217.]

GREGORY, W. M. **The growth of the cities of Washington.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 9, pp. 348-353.

GRIFFIN, J. A. **Washington thirty years ago.** *Washington Hist. Quart.*, Vol. 7, 1916, No. 2, pp. 133-135.

SOUTH AMERICA

GENERAL

MEANS, P. A. **An outline of the culture-sequence in the Andean area.** Maps, bibliogr. *Proc. Nineteenth Internatl. Congress of Americanists held at Washington, Dec. 27-31, 1915*, pp. 236-252. Washington, D. C., 1917.

The special interest of this paper lies in its use of the geographical method. Graphical representation of distribution in time is accompanied by graphical representation of distribution in space. In his "South American Archaeology," Joyce shows a short series of maps illustrating the growth of the Inca Empire: this has been amplified by Means. Chronological tables of pre-Inca civilizations—including the several coast areas from the Chimu to the Nasca valleys, Ecuador and the Diaguite (northwestern Argentina) region—are orientated by a map showing their localization and their relation to the great megalithic (Tiahuanacu) empire believed by Means to have flourished between 200 B. C. and 600 A. D. The map is based on archeological material, but a certain support is given by the historical data of Montesinos. With the recent favorable light cast on the heretofore condemned work of Montesinos is associated a revival of confidence in the reliability of Garcilaso de la Vega as historian. Upon this latter point turns the value of the series of maps (IV-XII) showing the growth of the Inca Empire. After a careful consideration of the very divergent substance of our two chief sources of Inca history—Garcilaso's "Royal Commentaries of the Incas" and Sarmiento de Gamboa's "History of the Incas"—Means strongly supports the former, and his maps are essentially based on Garcilaso's statements.

One of the improbable features of Sarmiento's account is the sudden expansion of the empire asserted to have taken place between the reigns of Viracocha and Pachacutec (eighth and ninth Incas respectively), an expansion from an area of a few square leagues around Cuzco to a consolidated realm stretching from Quito to Potosí, a latitudinal stretch of 20°. The growth depicted in the maps based on Garcilaso appear far more conformable both to what we know of the character of the empire and of the geographical circumstances in which it developed.

EUROPE

BRITISH ISLES

JEVONS, H. S. **The British coal trade.** xii and 876 pp.; map, diagrs., ills., bibliogr., index. (Series: National Industries, edited by Henry Higgs.) Kegan Paul, Trench, Trübner & Co., Ltd., London, and E. P. Dutton & Co., New York, 1915. \$2.25. 7½ x 5½.

This interesting and instructive volume covers practically every important aspect of the coal-mining industry and of the coal trade of the British Isles, though emphasis is laid upon the economic and social aspects. Scientific and technical problems are not disregarded, but the daily tasks and social life of the mining population are kept in the foreground, and so are the economic and commercial bearings of the industry. The importance of the coal industry in the national life is appreciated when we recall that it supports some five millions of inhabitants and that it is the corner-stone of Britain's manufacturing and commercial life.

There are twenty-eight chapters written in a style which can be easily understood by the educated general reader. A wide range of topics is covered. The nature of coal and of coal seams, the numerous uses of coal, methods of mining and preparation for the market, by-products of the industry, methods of paying wages and of marketing, safety devices in the mines, legal safeguards and inspection, miners' trade unions, conciliation boards, routine work of the miner, housing problems, and numerous other topics come in for illuminating description or discussion. The final chapter contains an excellent summary of the world's coal resources. The author states that he "can give good reasons for supposing that the condition of serious exhaustion due to consumption of three-fourths of the world's total store may well occur at no later date than 400 or 500 years hence."

A good deal of valuable material is relegated to an appendix of nearly one hundred pages. Here are included, among other data, lists of the largest colliery companies operating in leading British coalfields, a sample sale contract form, extracts from the Coal Mines Act of 1911, rules of the miners' federation of Great Britain, and a substantial classified bibliography. A considerable number of illustrations and diagrams and a large geological map of the British Isles add greatly to the usefulness of the work.

AVARD L. BISHOP.

TOMLINSON, W. W. **The North Eastern Railway: Its rise and development.** xvi and 820 pp.; maps, diagrs., ills., index. Andrew Reid & Co., Ltd., Newcastle-upon-Tyne, and Longmans, Green & Co., London, [1914]. \$5.63. 10 x 8.

The North Eastern Railway and its branches ramify throughout the counties of Northumberland, Durham, and Yorkshire, "the native land of railways." Here was opened in 1825 the first public line on which steam locomotion was used. This earliest line, the Stockton and Darlington Railway, originated as direct descendant of the mineral tramways. From 1620 to 1820 the region had been the scene of constant experimentation in transportation. Relaid and adapted to modern locomotion the present system includes some of the old roads along which coal has been carried without intermission for nearly two hundred years. The great eighteenth century development of the inland waterways counts as another factor in the history of these railways. Craze for canal construction resulted in a very complete topographical survey of the area.

BOSWORTH, G. F. **Ships, shipping, and fishing, with some account of our sea-ports and their industries.** (Cambridge Industrial and Commercial Ser., gen. edit.: G. F. Bosworth.) v and 86 pp.; maps, diagrs., ills., index. G. P. Putnam's Sons, New York. 45 cents. 8 x 5½. [Interesting elementary account of British shipping and the fishing industry. There is a chapter on the Cinque Ports and their decline, due in part to the eastward drift of sand along the coast which choked the ports and made them inland towns.]

— **British canal system, The.** Map. *Engineering Suppl. of the London Times*, No. 508, 1917, Feb. 23, pp. 44-45. [Abstracted in the *October Review*, p. 319.]

CHREE, C. **The magnetic storm of August 22, 1916.** Diagrs. *Proc. Royal Soc.*, No. 649, Ser. A, Vol. 93, 1917, pp. 177-187. [Observed at Eskdalemuir, Scotland, and Kew.]

CHUBB, L. W. **Highways and byways.** *Journ. Roy. Soc. of Arts*, No. 3352, Vol. 65, 1917, pp. 244-255 (discussion, pp. 254-255). [On the historical freedom of the King's Highway.]

RUSSIA

COXWELL, C. F. *Through Russia in war-time.* 312 pp.; map, ills., index. Charles Scribner's Sons, New York, [1917]. 9 x 6.

It is a staunch traveler who undertakes in war time a journey like the great loop which Mr. Coxwell made from Archangel to Baku and back along the Volga across Russia, Finland, Sweden, and Norway to England. The author wisely fortified himself for the trip with three weeks' study of Russian in Petrograd; nevertheless his difficulties with the language were considerable, and one can but admire his courage and address in surmounting them. At times he gave way to the temptation of speaking in German when it was clear that this language was known to his interlocutor, but almost always with the unfortunate result of bringing on himself the suspicion of espionage. From the care with which the authorities in the remotest places scrutinized Mr. Coxwell's passports, it is evident that even rural Russia is fully alive to the dangers and difficulties of the time.

Although there is much of value in the portion of the book describing Archangel and Petrograd and the cities of central Russia, to many the most interesting part will be the chapters dealing with the less well-known Crimea and Caucasus. After visiting Balaclava and Inkerman the author proceeded by a fifty-mile motor drive to Yalta on the Black Sea. He speaks of this part of the trip with enthusiasm. At Baidar Gate from a bold rocky coast they looked down to the "blue Euxine" seventeen hundred feet below, then after a delightful drive reached "surpassing Yalta," with its background of pine-covered mountains four thousand feet high and the city and promenade along the edge of the sea.

The work is illustrated throughout with interesting photographs taken by the author. Comments on the scenery are mingled with casual observations on the peoples visited, their habits and costumes. For example, remarking on the legend and romance with which the whole Caucasus is alive, the writer speaks of the Ossetes, who have a language akin to the Persian, and wonders whether they are descended from the Sarmatians who, escaping from the Goths, maintained themselves near ice-bound Mount Kasbek, the region where classic Prometheus was said to have suffered for aiding mankind. At the same time the author discusses philosophically the dangers into which a traveler falls, of offensive pedantry on the one hand, and of missing choice opportunities for observation on the other. Traveling through Georgia, ceded to the Russian Czar in 1800, the author visited Mtskheta, its ancient capital, mentioned in the writings of Ptolemy, Strabo, and Pliny and claiming its first ruler to have been of the fifth generation from Noah. He calls it now "a miserable place," with its only activity the manufacture of coarse pottery. The country of the Khirghiz and the Kalmucks is fully described, with its somewhat unattractive inhabitants. Through a kindly peasant with whom he dined Mr. Coxwell learned the relative value of the horse and the camel in farm work. The cost being the same—twenty pounds—the camel is two or three times stronger than the horse and can live on coarser fare.

In conclusion Mr. Coxwell points out that Russia, the land of enigmas, is in a condition of such active evolution that it must long fascinate those loving to study man's development. He looks forward to its future with confidence and bespeaks sympathy for its generous and warm-hearted people.

R. H. JONES.

— *Apsheron Peninsula, The remarkable oil fields of the.* Map. *Russia*, Vol. 2, 1917, No. 4, pp. 15-22. New York. [Region about Baku on the Caspian Sea.]

BLANC, ÉDOUARD. *Le chemin de fer de Pétrograd à la côte Mourmane.* *Ann. de Géogr.*, No. 133, Vol. 25, 1916, pp. 47-60. [For an article on the same topic, see the *Review*, Vol. 1, 1916, pp. 128-132.]

BLINK, H. *De Ukraine of Klein-Rusland.* Bibliogr. *Vragen van den Dag*, Vol. 31, 1916, No. 8, pp. 577-594.

BRAUNER, A. *Notes sur la zoogéographie de la Crimée.* Ills. *Recueil publié à l'occasion du vingt-cinquième anniversaire du Club Alpin de Crimée et du Caucase*, pp. 172-177. Odessa, 1915. [In Russian.]

BRUNOFF, P. *Russian meteorological science and agricultural investigation.* Translated by the Canadian branch of the International Institute of Agriculture. Map, ill. *Russia*, Vol. 2, 1917, No. 3, pp. 21-27.

— *Crimea, The wonderful.* Map, ills. *Russia*, Vol. 2, 1917, No. 2, pp. 15-22. New York.

GAY, E. F. *Russia-America: Economic doubles.* *Russia*, Vol. 1, 1916, No. 1, pp. 5-6. New York. [A short comparison between Russia and America. Both are plains

countries in a broad sense. Both have a great variety of still undeveloped resources. Cheap railroads and sparse population in large sections, great continental areas, chiefly agricultural exports, high tariffs, and a debtor relation to primarily industrial nations, are among the points of comparison.]

GIBRALTAR, BISHOP OF [H. J. C. KNIGHT]. **British communities in South Russia: Links with England.** Map. *London Times Russian Section*, No. 28, 1917, Jan. 27, p. 11. ["The English communities in Russia of today are the mercantile successors of these pioneers of the sixteenth century" (i. e. of "The Muscovie Company").]

AUSTRALASIA AND OCEANIA

AUSTRALIA, NEW ZEALAND

— **Royal Geographical Society of Australasia, South Australian Branch, Proceedings of the Society for the Session 1913-14**, Vol. 15. xvi and 238 pp.; maps, diags., ills. Adelaide, 1915.

Contains unusually valuable notes on the history of exploration of Central and South Australia. The President's annual address consists of a history of early inland exploration and deals particularly with the explorations of Edward John Eyre, Sir Paul Edmund de Strzelecki, and Captain Charles Sturt.

The volume also contains a chapter on the Crozet Islands, the scene of many shipwrecks whose history has formed the basis of various tales of adventure. The most celebrated of the shipwrecks are described. There is a brief note on the Australian Antarctic Expedition and also on the storage of water in the River Murray. The volume is accompanied by a map of a portion of South Australia showing Eyre's track in 1839-41. A second map shows the country explored by the Central Australian Expedition under the command of Captain Sturt in 1844-46.

The most important paper is entitled "Journal of the Government North-West Expedition (March 30-November 5, 1903)" by Herbert Basedow. In 1903 the Parliament sent a party of explorers and prospectors into the farthest northwest country of the state of South Australia. The expedition left Oodnadatta, the terminus of the Great Northern Railway, during the historic rush to the Arltunga goldfield. Mount Todmorden Station on the Alberga River was the last outpost of settlement on the proposed route. The expedition left this point April 13. The party consisted of eight whites and several natives and traveled with a string of twenty camels. Mr. Basedow's report of the expedition is in the form of a diary which gives the localities of the march, including meteorological observations and notes on the character of the rock, the soil, the vegetation, and the natives. This form of presentation leaves the material in an unorganized condition so that one must read the whole account in order to obtain a connected idea of any features of special interest. It is, however, an exceedingly valuable report on a little-known region and will for some time to come form the basis of our knowledge of the natural history and geography of a remote part of South Australia.

ANDERSON, C. **Bibliography of Australian mineralogy.** 164 pp. *Geol. Survey of New South Wales: Mineral Resources No. 22*, Sydney, 1916.

ASTON, B. C. **The vegetation of the Tarawera Mountains, New Zealand.** Ills., bibliogr. *Trans. and Proc. New Zealand Inst.*, Vol. 48, 1915, pp. 304-314. Wellington, 1916. ["This area presents peculiar facility for the study of the spread of species on new ground, since only an infinitesimal fraction of the plants could have survived the 1886 eruption."]

— **Australia, Climate and labour in northern.** Map. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 6, pp. 289-290. [Note on an article in the *Pastoral Review*. "The article contains two points of special interest, one dealing with the climate of the region and the other with the question of the efficiency of white workers in tropical climates."]

BALL, L. C. **The Etheridge mineral field.** 58 pp.; maps, ills. *Geol. Survey of Queensland Publ. No. 245*. Brisbane, 1915. [This field occupies over 12,000 square miles to the south of Cape York Peninsula. It has been exploited for gold, silver, copper, lead, zinc, tin, tungsten, and bismuth.]

BARCLAY, H. V. **Report on exploration of a portion of central Australia by the Barclay-Macpherson Expedition, 1904-1905.** *Proc. Roy. Geogr. Soc. of Australasia, South Australian Branch: Session 1914-1915*, Vol. 16, pp. 106-130. Adelaide, 1916.

BARTRUM, J. A. **High-water rock-platforms: A phase of shore-line erosion.** Diagr., ills. *Trans. and Proc. New Zealand Inst.*, Vol. 48, 1915, pp. 132-134. Wellington, 1916. [A study in a location of classic interest. The "Old Hat" island, Bay of

Islands, Auckland, was used by J. D. Dana in his exposition of the development of submarine platforms.]

BASEDOW, HERBERT. *Journal of the Government North-West Expedition (March 30–November 5th, 1903)*. Map, diags., ills. *Proc. Roy. Geogr. Soc. of Australasia, South Australian Branch: Session 1913-14*, Vol. 15, pp. 57-238. Adelaide, 1915. [Reviewed above in the first entry in this section.]

PHYSICAL GEOGRAPHY

METEOROLOGY AND CLIMATOLOGY

CARPENTER, F. A. *The aviator and the Weather Bureau*. 35 pp.; diags. and ills. San Diego Chamber of Commerce, San Diego, Cal., 1917.

It is increasingly evident that in modern warfare flying has to be carried on under almost all weather conditions. On the other hand, it is becoming more and more obvious that aviators are today recognizing the importance of the meteorological factor as never before. They realize the need of a sound, simple, practical knowledge of certain elementary facts in connection with weather conditions and their changes, at the surface and at ordinary flying heights. At the cadet schools of the Royal Flying Corps, in England and in Canada, instruction in meteorology is recognized as an essential part of the course of preliminary training, and in the new schools of military aéronautics, recently established by the U. S. War Department at several universities and technical institutions in this country, lectures on meteorology are included in a five weeks' course of instruction.

There will doubtless be an immediate and rapid increase in publications dealing with such aspects of meteorology as are of the greatest importance in aviation. Dr. Carpenter's little book is one of the first of this sort. It gives a brief history of aviation in Southern California; a description of the War Department school of aviation at San Diego; a syllabus of two lectures given at that school on meteorology in relation to aviation; a brief account of weather observations made during an airplane flight, and the results of meteorological observations obtained in the free air in Southern California. Dr. Carpenter's little volume is an interesting report; in no sense exhaustive, but suggestive of the importance of the subject rather than indicative of its scope. There is a distinct and growing need for the publication of a well-considered and fairly complete syllabus of a course of instruction in practical meteorology adapted to the needs of aviators.

R. DEC. WARD.

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ERRATA

- p. 58, line 19 from bottom: *for* the highest peak east of the Rockies *read* the highest glaciated peak east of the Rockies.
- p. 76, review of book by Madeline Alston: *supply signature* Cyrus C. Adams.
- p. 78, line 13: *for* 1917 *read* 1916.
- p. 90, title of Fig. 10: *for* Jiggling *read* Jigging.
- p. 148, line 1: *for* Kabarovsk *read* Khabarovsk.
- p. 161, line 3: *for* Former Surveyor General of India *read* Formerly Superintendent of Frontier Surveys in India.
- p. 217, note on Avalanche Wind Near Juneau, Alaska: *supply source*: M. B. Summers: Avalanche Wind at Juneau, January 26, 1917, *Monthly Weather Rev.*, Vol. 45, 1917, p. 114.
- p. 219, Fig. 1: *complete title as follows*: Scale, 1:8,800,000, or 138 miles to the inch [the linear scale is incorrect]. Symbols: (1) black, irrigated land; (2) ruling, irrigable land; (3) stippling, desert plains; (4) dotted line, limit between mountain zone of annual rains at intervals of several years; (5) dash line, crest of Maritime Cordillera, or Cordillera Occidental. (Excerpt from Fig. 66 of Isaiah Bowman's "The Andes of Southern Peru," New York, 1916.)
- p. 224, line 3 of title: *for* 1914 *read* 1913.
- p. 228, line 10: *for* clasificacion *read* clasificación.
- p. 231, line 26: *for* Copenhagen *read* Copenhagen.
- p. 231, line 11 from bottom: *for* Grand *read* Grande.
- p. 260, footnote 9: *supply pagination as follows*: pp. 323-324 and 331-334.
- p. 299, at end of explanation of Fig. 1: *for* give the mean elevation in feet of each five-minute rectangle *read* give the average difference in elevation between the highest points and the lowest points in each five-minute rectangle.
- p. 321, line 13 from bottom: *for* are *read* is.
- p. 346, on the map in the aëroplane shown on the drawing (Fig. 12): *dele* Potomac R. (*This is the Anacostia River*).
- p. 413, line 15 from bottom: *for* Vol. 1 *read* Vol. 2.
- p. 490, line 23 from bottom: *for* will permit the mariner *read* will afford the mariner.
- p. 500, line 3 from bottom: *for* appear *read* appears.

ADDITIONAL ERRATA IN PREVIOUS VOLUMES

Vol. I

- p. 217, line 6 from bottom: *for* O. A. Freeman *read* O. W. Freeman.

Vol. III

- p. 231, footnote 23: *denominator in formula should be* $\sqrt{2n-1}$.
- p. 249, next to last line: *for* Vol. 38 *read* Vol. 35.
- p. 419, lines 5 and 6: *for* types of vegetation extend bandlike through *read* vegetational limits cross the range at.
- p. 481, line 4 of article: *for* (9750 feet) *read* (9671 feet).
- p. 499, line 3 of last item before "South America": *for* pp. 99-100 *read* pp. 99-110.





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